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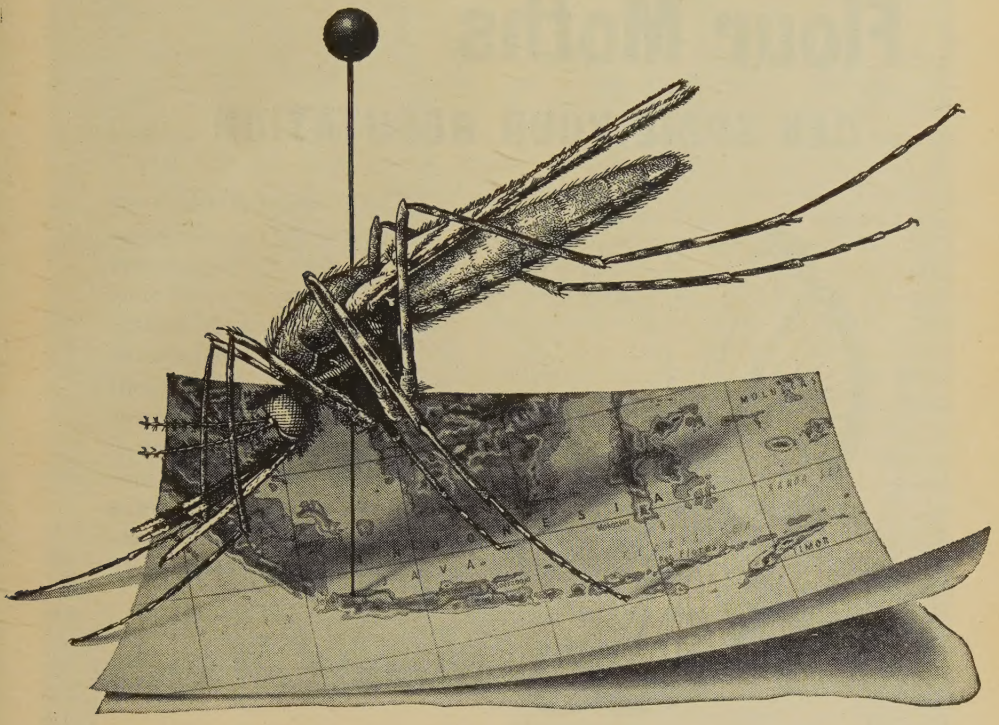

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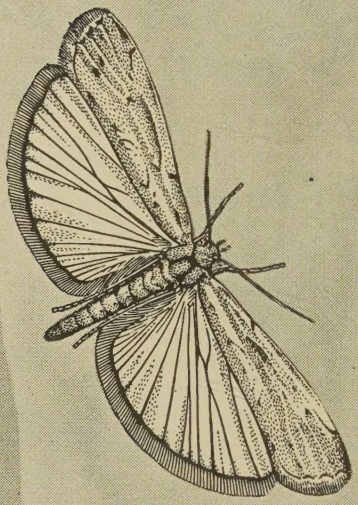

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Baker (E. W.) & Pritchard (A. E.). **A Guide to the Spider Mites of Cotton.**—*Hilgardia* **22** no. 7 pp. 203–234, 24 figs. (1 col.), 29 refs. Berkeley, Cal., 1953.

The Tetranychids dealt with in this revision are chiefly those recorded from cotton in the United States, but a few from other countries are included. *Septanychus* [*R.A.E.*, A **8** 145] is considered congeneric with *Tetranychus*, and keys to the species of *Tetranychus* known from cotton in North and Central America are given. Those recorded from the crop in the United States are *T. pacificus* McG., which is a serious pest of cotton in California, *T. schoenei* McG., *T.* (*S.*) *canadensis* (McG.), *T. bimaculatus* Harvey, for which *T. telarius* (L.) may be an earlier name [but *cf.* **39** 102], *T. atlanticus* McG., which is of main importance on cotton in California, *T. desertorum* Banks, of which *T. opuntiae* Banks [*cf.* **28** 222], *T. thermophilus* Ewing [**14** 294], *T.* (*S.*) *argentinus* (McG.) [**32** 144], *T.* (*S.*) *deserticola* (McG.) [**39** 102] and *T.* (*S.*) *texazona* (McG.) [**39** 102] are synonyms and which is the dominant mite on cotton in Texas [*cf.* **39** 166], and *T. tumidus* Banks, of which *T. gloveri* Banks [**17** 45], *T. antillarum* Banks [**5** 314] and *T.* (*S.*) *quinquenychus* (McG.) [**8** 145] are synonyms. *T. marianae* McG., which occurs in the Mariana and Marshall Islands, Nicaragua, the Bahamas, Florida and Argentina, is also known to be a pest of cotton. *Petrobia latens* (Müller), which is common on grasses in the western United States [*cf.* **40** 116], sometimes infests young cotton there in spring. Notes are given on the identification, bionomics, food-plants and distribution of all these mites, so far as known. *Paratetranychus mcgregori*, sp. n., is described from adults of both sexes taken on cotton in Nicaragua, and *P.* (*T.*) *trinitatis* Hirst [**17** 333] is stated to be a synonym of *P. peruvianus* (McG.), which infests cotton in Peru and also occurs, though not on cotton, in Trinidad and southern California.

Kern (F.). **Recomendaciones para el combate del cogollero o barredor de maíz y arroz,** *Laphygma frugiperda* **S. y A.** [Recommendations for the Control of *L. frugiperda* on Maize and Rice.]—*Bol. Ext. Inst. nac. Agric. Venez.* no. 8, [1+] 15 pp., 7 figs. Maracay, 1954. (With a Summary in English.)

Laphygma frugiperda (S. & A.) is a serious pest of maize and rice in Venezuela. Oviposition occurs in the fields and in grassland at the beginning of the winter rains, the moths apparently originating in the uplands, and three overlapping generations develop on the crop, the first being completed in about a month. The larvae migrate in large numbers, and the attack is often sudden, especially in the neighbourhood of uncultivated land. As a result of tests in 1953, toxaphene, BHC, DDT and endrin are recommended for control of the larvae, BHC being the most rapid in action, and a schedule comprising sprays of various materials and dust-barrier treatments with toxaphene is suggested.

de Aguiar Guimarães (J.). **Sôbre um novo Psyllidae da goiabeira.** [On a new Psyllid on Guava.]—*Agronomia* **12** no. 2 pp. 39–43, 4 figs., 4 refs. Rio de Janeiro, 1953. (With a Summary in English.)

Descriptions are given of the nymph and adults of both sexes of *Ceropsylla guyavae*, sp. n., which was found causing deformation of the young leaves of guava near Rio de Janeiro in December 1952. The deformation, which consisted mainly of rolling, is described. The Psyllid disappeared in early

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January, but even larger numbers were present at the end of the month, after which they again disappeared for about a month. The eggs were not found.

Carneiro Ribeiro (J. H.). **Sôbre um inimigo do** *Bidens pilosus*. [On a Pest of *B. pilosa*.]—*Agronomia* **12** no. 2 pp. 51–53, 3 figs. Rio de Janeiro, 1953.

Larvae of the Chrysomelid, *Phaedon pertinax* Stål, were found feeding on seedlings of *Bidens pilosa* near Rio de Janeiro in April 1953. When full-fed, the larvae pupated in the soil, and adults emerged after 6–8 days. Both larvae and adults were attacked by nymphs of the Pentatomid, *Stiretrus erythrocephalus* Lep. & Serv.

Soulie (H.). **La sésie du groseillier en 1954.**—*Phytoma* **7** no. 60 pp. 22–24, 3 figs., 1 graph. Paris, 1954.

Further observations by the technique previously used [*R.A.E.*, A **42** 248] were made in 1954 on the bionomics of the currant borer [*Aegeria tipuliformis* (Cl.)] on black currant in east-central France, to determine the best time for the application of insecticides. Adults were observed from 25th May to 30th June, the bulk of the emergences occurring when the temperature was over 15°C. [59°F.], and pairing was first noted on 3rd June. The females oviposited only during the three days following pairing, and the first eggs were found on 6th June, the majority being laid between 16th and 19th June, when the temperature ranged from 16 to 22°C. [60·8 to 71·6°F.]. The larvae normally hatched in 7–8 days, but did so in six days at 22°C. Dusts and sprays of BHC were applied on 14th–15th June, at the height of oviposition, but the results would not be known until the following year.

Reiff (M.). **Untersuchungen zum Lebenszyklus der Frostspanner** *Cheimatobia* (*Operophthera*) *brumata* **L. und** *Hibernia defoliaria* **Cl.** [Investigations on the Life-cycle of the Winter Moths, *Operophtera brumata* and *Erannis defoliaria*.]—*Mitt. schweiz. ent. Ges.* **26** pt. 2 pp. 129–144, 4 figs., 22 refs. Berne, 1953.

The life-cycles of *Operophtera* (*Cheimatobia*) *brumata* (L.) and *Erannis* (*Hibernia*) *defoliaria* (Cl.) in western and central Europe are characterised by a short adult life in November, overwintering of the eggs in December–April, a short larval stage in April–May and a long pupal stage in June–November. Though the alternation of short and long stages is uniform for all climatic zones, the pupal stage is shorter and the egg stage longer in northern districts and at high altitudes, while the converse is true south of the Alps, and field and laboratory investigations were therefore carried out near Basle in 1947–51 on the way in which the individual stages are linked with the appropriate seasons. Both species occur on fruit trees in the area concerned, and *O. brumata* is particularly numerous on cherry. The results obtained were valid for both.

Material for laboratory rearing was obtained by surrounding the trunks of the trees with a band of coarse cloth about 4–6 ins. wide surmounted by a strip of aluminium foil about 6 ins. wide with the upper edge bent outwards. The wingless females were unable to pass the aluminium foil when crawling up the trunks and paired and oviposited on the cloth, from

which they and the eggs could be collected. Observations on the formation of the egg chorion are described. Embryonic development began immediately the eggs were laid, but was interrupted after a few days by diapause [*cf. R.A.E.*, A **41** 167]. The duration of the egg stage varied with temperature and at constant temperatures in the laboratory required a total of about 600 day-degrees C. [1,080 F.] for completion, 0°C. [32°F.] being taken as the threshold of development [*cf.* **23** 296, etc.]. Of this, about 100 day-degrees C. [180 F.] was required during the period preceding diapause, 280–300 day-degrees C. [504–540 F.] during diapause and about 200–220 day-degrees C. [360–396 F.] for subsequent development. When eggs were collected in the field at different times during the winter and exposed to warmth, it was found that the diapause was completed in all cases during January. Development in the field was restricted in February by low temperatures, the average lying below 3°C. [37·4°F.], and in practice depended on temperature conditions from 1st March onwards. Hatching in the field usually occurred about 7th–8th April, by which time a temperature sum of 220–230 day-degrees C. [396–414 F.] was normally attained. The development of fruit trees has also been shown to be governed by the temperature sum from 1st March, so that early cherries are in blossom near Basle when the larvae hatch.

The course of adult emergence in 1947–49 and 1951 is shown on graphs. The maximum was normally reached about mid-November, but there was no distinct peak in 1949, when the autumn rains began late. Observations over several years under very different weather conditions showed that the pupal stage averaged 180 days and was largely unaffected by temperature [*cf.* **26** 421], though it was prolonged in the laboratory by high soil humidity, which also caused high mortality [*cf.* **21** 58], and emergence was delayed by drought [*cf.* **23** 62].

Attempts were made to accelerate the development of *E. defoliaria* by rearing under optimum conditions for two years in the laboratory. Only the egg stage was appreciably shortened, and adults were obtained from mid-September of the first year and in June of the second. Refrigeration was not necessary for the development of the eggs, and since all stages could be kept under conditions different from those that they normally encounter in the field, the adults for instance at 20°C. [68°F.], it is concluded that the seasonal link is provided by the mechanism regulating embryonic development in these species [*cf.* **41** 167–168].

Wille (H.) & Wildbolz (T.). **Beobachtungen über die Eiablage des Maikäfers und die Entwicklung des Engerlings im Laboratorium.** [Observations on Oviposition by Cockchafers and larval Development in the Laboratory.]—*Mitt. schweiz. ent. Ges.* **26** pt. 3 pp. 219–224, 8 refs. Berne, 1953.

In a project for large-scale laboratory rearing of Melolonthids in Switzerland, pairing adults of *Melolontha melolontha* (L.) (*vulgaris* F.) were collected in the field at the end of April 1952 and caged individually over flower-pots of soil in the manner described by Schuch [*R.A.E.*, A **26** 717], or in numbers over soil in boxes, and the females allowed to oviposit. The latter method was also used for *M. hippocastani* F. The numbers of eggs deposited per female of *M. melolontha* averaged 19 in the first batch and 12·8 in the second. In all, 64·1 per cent. of the eggs hatched, the first larvae being observed six weeks after the experiment began. The larvae were reared in small tins filled with soil or ground cork and given wheat grains and slices of carrot as food. Mortality was comparatively low

at temperatures of 18 and 23·5°C. [64·4 and 74·3°F.]. By August 1953, the larvae of *M. melolontha* were still in the third instar, but two adults of *M. hippocastani* had emerged. One developed at 23·5°C., the three larval instars and the pupal stage lasting 33, 28, 121 and 40 days, respectively, and the other at 18°C., at which they lasted 41, 45, 234 and 38 days. The possibility of *M. hippocastani* completing its development in two years in the field is discussed. Newly moulted larvae in the third instar have been observed in the autumn of the flight year, but pupation would occur in the following August only if the soil temperature from April onwards averaged at least 23·5°C., which is unlikely in central Switzerland.

Jones (F. G. W.) & Humphries (K. P.). **The Use of Seed Dressings containing γ-BHC in the Establishment of Sugar-beet Seedlings.**—*Ann. appl. Biol.* **41** no. 4 pp. 562–577, 2 graphs, 4 refs. London, 1954.

The following is virtually the authors' summary. From 1949 to 1952, field trials were made in eastern England to determine the effect of seed dressings containing γ BHC, with and without the addition of organic mercurial compounds, upon the establishment of sugar-beet seedlings. Most of the trials were made in fields where no serious pest problems were anticipated. The 1949 trials established the concentration of γ BHC non-phytocidal to sugar-beet seedlings. Later trials tested the effect on pre- and post-singling plant populations of dressings applied to natural or rubbed seed sown at standardised rates. Parallel tests of dressed seed were made on farms representing a variety of soil types. It was found that the phytotoxicity of γ BHC varied with season and soil type, but that a dressing containing 40 per cent. was usually safe.

In these trials, the benefits from seed dressing were, as a rule, slight. Generally, the combined seed dressing gave the best pre-singling stand of plants. Most of the improvement was attributable to the organic mercury rather than to the γ BHC, but where pest attacks occurred γ BHC gave marked improvements in stand. Wireworms appeared to be the chief pest controlled; control of *Atomaria linearis* Steph. was only partial.

Tarr (S. A. J.). **Protection of Sorghum against Soil Fungi, Soil Pests and Covered Smut by combined Insecticide-Fungicide Seed Dressings.** —*Ann. appl. Biol.* **41** no. 4 pp. 578–585, 3 refs. London, 1954.

Lamellicorn larvae have been reported in the Gezira area of the Sudan as injurious to sorghum [*R.A.E.*, A **25** 218], dolichos beans (*Dolichos lablab*) [**29** 388] and the roots of cotton, and are potentially serious pests there. An account is given of experiments in 1948–53 on the effectiveness of seed dressings in protecting sorghum from them and from fungi, the main test against Lamellicorns being carried out in a field in which larvae of the genus *Schizonycha* were common. The following is taken from the author's summary of the results. Powder dressings containing 20–40 per cent. γ BHC applied at the rate of 1 gm. per lb. of seed effectively protected sorghum seedlings from root attack by *Schizonycha* and significantly increased stands and yields. No certain evidence of this effect was obtained with *D. lablab* or groundnuts, and the different responses shown by these plants as compared with sorghum are attributed largely to differences in seed germination and root system. Treatment with 40 per cent. γ BHC was sometimes slightly but appreciably phytotoxic to sorghum in the field and more markedly so in greenhouse experiments. A powder containing 25 per cent. thiram (tetramethyl thiuram disulphide) and 20 per cent.

γ BHC applied at the rate of 1 gm. per lb. of seed is recommended as the standard dressing.

Miles (M.). **Field Studies on the Influence of Weather on Egg-laying by the Cabbage Root Fly, *Erioischia brassicae* Bché. II.**—*Ann. appl. Biol.* **41** no. 4 pp. 586–590, 3 graphs, 5 refs. London, 1954.

The following is virtually the author's summary of this second part of a series [*cf. R.A.E.*, A **42** 409], in which an account is given of observations in south-eastern England in 1953 on oviposition by *Hylemyia* (*Erioischia*) *brassicae* (Bch.) on the plot of land previously used, which was planted with cauliflowers. Eggs were first observed on 21st April, and the spring peak period of egg-laying lasted from 3rd to 30th May with a daily average of 40 eggs per plant. The mean total in the spring of 1953 was 1,287 eggs per plant. Summer peaks occurred on 1st–20th July (average 17 eggs per day per plant) and 5th–11th August (average 21 eggs per day per plant).

In the field, the threshold of oviposition was approximately 60°F. The rate of egg-laying was highest at 65–70°F., and it declined during prolonged periods of higher temperatures.

The annual cycle of generations, as shown by egg counts and confirmed by the examination of puparia, consisted of two generations and a partial third. The spring generation developed without a prolonged diapause, and there was complete emergence during the summer. The overwintering puparia came from larvae of the second and third generations.

Miles (M.). **Studies of British Anthomyiid Flies. VI. The annual Cycle of Generations in some Anthomyiid Root Flies.**—*Bull. ent. Res.* **46** pt. 1 pp. 11–19, 13 refs. London, 1955.

The following is largely the author's summary of this part of a series [*cf. R.A.E.*, A **41** 447, etc.]. An account is given of field and laboratory studies in south-eastern England showing that several root-infesting Anthomyiids differ greatly in the number of generations a year and in the minimum temperatures necessary for full activity.

The onion fly, *Hylemyia* (*Delia*) *antiqua* (Mg.), was mainly univoltine in laboratory cultures. Of 369 first-generation pupae studied in 1953, only 141 (about 40 per cent.) gave rise to adults in July–August, and 228 (about 60 per cent.) entered diapause. Of these, 196 (about 85 per cent.) remained in diapause until the following spring. In 1954, 99 per cent. of the first-generation pupae from univoltine flies and 97 per cent. of those from bivoltine flies entered diapause in July. Exposure to low temperatures during the development of the first-generation larvae appeared to have induced the diapause in the pupae, and this was confirmed by the unexpectedly high proportion (49 per cent.) of first-generation pupae collected in the field that entered diapause in July in the cool summer of 1954. It was also established that the spring oviposition period of *H. antiqua* began about the end of May, and it appeared that air temperatures of about 70°F. were apparently necessary in the field to stimulate egg-laying. First-generation adults emerged in the second and third weeks of July, their numbers depending on the temperature in June. A few second-generation adults, together with late first-generation flies, sometimes emerge in September, but the temperature is then too low for oviposition and no third-generation larvae seem to occur.

The annual cycle of the cabbage root fly, *H.* (*Erioischia*) *brassicae* (Bch.), comprised two generations and a partial third [*cf.* preceding abstract].

Oviposition usually began in the latter part of April [**42** 409] and was associated with an air temperature of at least 60°F. [**39** 426]. There was virtually complete emergence of flies from first-generation pupae, counts in 1953 and 1954 showing that only 0·5 and 1·6 per cent., respectively, entered diapause. Highest numbers of flies occurred in the first half of July, but the weather adversely affected survival [*cf.* **42** 410] and they laid relatively few eggs. Some second-generation adults emerged in the first half of August, but few eggs were laid, although the weather appeared favourable. Overwintering pupae were derived from eggs laid by flies of the first and second generations.

Pupae of the turnip root fly, *H.* (*E.*) *floralis* (Fall.) were transferred in winter from Ross (northern Scotland) to Kent (south-eastern England) without affecting the period during which adult emergence occurred, though the peak appeared to be advanced from the first half of August to the second half of July. In Scotland, the first-generation larvae normally feed in late summer and early autumn, and there appears to be only one generation a year. In rearing tests, the higher temperatures of Kent accelerated larval and pupal development and led to the emergence of adults in September, when the temperatures were too low for oviposition.

The development of successive generations of the bean seed flies, *H.* (*D.*) *cilicrura* (Rond.) and *H.* (*D.*) *trichodactyla* (Rond.) appears to be limited only by temperature, oviposition requiring a minimum air temperature of 60°F. in the field. The evidence indicates that there are four generations a year in England, high populations of third-generation adults occurring in late September and early October.

Miles (M.). **Studies of British Anthomyiid Flies. VII. The Onion-fly Complex.**—*Bull. ent. Res.* **46** pt. 1 pp. 21–26, 17 refs. London, 1955.

The following is based on the author's summary of this further part of a series [*cf.* preceding abstract, etc.]. Onion crops in Britain are attacked by Anthomyiid larvae from May to August. Two species are concerned, *Hylemyia* (*Delia*) *antiqua* (Mg.), which in some seasons is mainly univoltine and attacks the crop in June and July, and *H.* (*D.*) *cilicrura* (Rond.), which has 3–4 generations a year and is most injurious to spring-sown onions in May and to summer-sown onions in August. Oviposition by *H. antiqua* is the result of the chemotropic response of the species to its food-plants, but that by *H. cilicrura* follows the disturbance of the soil during cultural operations in April-May, and occurs again when seed-beds are prepared for August sowings [*cf. R.A.E.*, A **41** 447]. It is considered that seed-dressings of mercurous chloride (calomel) [*cf.* **27** 674, etc.] are unlikely to retain their ovicidal effect during the three months that elapse between sowing, which is usually carried out at the end of February, and oviposition by *H. antiqua* at the end of May, especially since plant growth causes the eggs to be deposited at a distance from the seed-coat bearing the ovicide. The dressings are unlikely to have a direct effect on infestation by *H. cilicrura*, the eggs of which are not necessarily laid on the seedlings and, in the case of August sowings, have hatched before the seed is sown.

Pitcher (R. S.). **A Comparison of a Group of Gall Midges of the Genus *Thomasiniana* Strand, E. 1916 and a Description of a new Species from wild Blackberry.**—*Bull. ent. Res.* **46** pt. 1 pp. 27–38, 1 fig., 10 refs. London, 1955.

The species of *Thomasiniana* that attack rosaceous plants in Britain are *T. theobaldi* Barnes, which is a pest of raspberries [*cf. R.A.E.*, A **41** 38],

T. oculiperda (Rübs.), which attacks newly budded rose and fruit-tree rootstocks [*cf.* **24** 225, 651], *T. crataegi* Barnes, which infests hawthorn (*Crataegus oxyacantha*) [**27** 673], and a species collected on wild blackberry that was thought to be *T. theobaldi* in 1943 [**32** 259] and is here described from adults of both sexes as *T. fruticosi*, sp. n.

In tests of food-plant preferences, *T. theobaldi*, *T. fruticosi*, and *T. oculiperda* from apple all oviposited on wild rose (*Rosa canina*), apple, wild blackberry and raspberry (the basic test plants), and *T. oculiperda* from rose on all except raspberry. *T. theobaldi* and *T. oculiperda* from apple also oviposited on hawthorn. Eggs of *T. theobaldi* were most numerous on raspberry, and the larvae completed their development only on this plant and rose [*cf.* **33** 308]; many other plants were tested with this species, but the larvae developed only on loganberry, which was as favourable for them as raspberry, and Himalaya Giant blackberry. *T. fruticosi* oviposited most freely on blackberry and laid some eggs on loganberry, but with the exception of a few on raspberry and rose, larvae became fully grown only on blackberry. *T. oculiperda* from apple oviposited most readily on apple, but on isolated occasions eggs were also laid on cherry, pear, blackthorn (*Prunus spinosa*), plum and peach; apart from an occasional survival on rose and, on the one occasion on which it was tested, blackthorn, the larvae completed their development only on apple. *T. oculiperda* from rose oviposited equally readily on this plant and on apple, and the larvae usually survived on the latter. Females of *T. crataegi* that were offered apple, blackberry, raspberry, rose, hawthorn, blackthorn, plum and cherry oviposited only on hawthorn, to which this species therefore appears to be confined.

Observations on the spring emergence of *T. theobaldi*, *T. oculiperda* from rose, *T. fruticosi* and *T. oculiperda* from apple in the insectary over four years showed that both first and peak emergences took place in the order given. *T. theobaldi* emerged at least seven days earlier than *T. fruticosi* and *T. oculiperda* from rose at least seven days earlier than the same species from apple.

Examination of adults and larvae of *T. theobaldi*, *T. fruticosi* and *T. oculiperda* from rose and apple showed the existence of morphological differences between the first two species and also between examples of *T. oculiperda* reared from rose and from apple, which are thought to represent two distinct strains. *T. crataegi* differed from all of them. No eggs were laid in crossbreeding experiments with *T. theobaldi* and *T. fruticosi*. Although the two strains of *T. oculiperda* can survive on either rose or apple, the apple strain is less adaptable and probably predominates in apple-growing areas, mainly as a casual inhabitant of broken branches; adults from such situations may oviposit on apple, rose and possibly rootstocks of fruit trees other than apple if budding is carried out during the emergence of a summer generation. The rose strain probably occurs mainly on hedgerow roses, but small populations may persist in rose nurseries, infesting small cuts in the bark when budding slits are not available. The known parasites of the four species are listed [*cf.* **41** 38].

Burt (P. E.) & Ward (J.). **The Persistence and Fate of DDT on Foliage. I. The Influence of Plant Wax on the Toxicity and Persistence of Deposits of DDT Crystals.**—*Bull. ent. Res.* **46** pt. 1 pp. 39–56, 2 graphs, 36 refs. London, 1955.

The following is substantially the authors' summary. The persistence and toxicity of DDT crystals on thin layers of plant wax were studied. Deposits of crystalline DDT were applied to glass plates, plain or coated

with a layer of wax 0·5μ thick obtained from leaves of sisal or cabbage, and the plates were stored for various periods at 18°C. [64·4°F.] and at 43°C. [109·4°F.] (representing temperate and tropical leaf-temperatures). The DDT remaining after storage was estimated biologically by means of its contact action on adults of *Tribolium castaneum* (Hbst.), and chemically by a modification of the Schechter-Haller method. At 18°C., there was no significant change in any of the deposits when estimated chemically, but biological estimation showed that, although the toxicity of the deposits on waxed plates was unchanged, that on glass plates was doubled after storage for eight days. The reason for this change was not discovered. At 43°C., the amount of DDT, estimated both chemically and biologically, diminished rapidly and was negligible after 26 days. The loss of toxicity at 43°C. was shown to be accompanied by loss of weight of the deposits. Loss at 43°C. from plain glass plates was much reduced by storing them in an atmosphere saturated with DDT vapour. It appeared, therefore, that loss of toxicity at the higher temperature was due to volatilisation of DDT and not to decomposition.

Plates coated with cabbage wax, stored at 43°C. in an atmosphere saturated with DDT vapour, absorbed the vapour rapidly up to a maximum of 1·7 per cent. of the weight of the wax. The plates were then toxic to *T. castaneum* crawling on them. DDT dissolved in the wax layer was found to be about as toxic as the same weight of crystalline DDT per sq. cm. on a glass surface. DDT dissolved in wax was found to be decomposed by short-wave ultra-violet radiation more rapidly than were DDT crystals. By irradiating deposits and then analysing them, it was shown that DDT crystals on wax surfaces, when stored for up to 14 days at 43°C. or 18°C., do not become dissolved in the wax to an appreciable extent, provided that the plates are stored in a ventilated container.

It is concluded that, although DDT can be taken up by a typical plant wax, this effect is unlikely to influence the toxicity of the deposit unless the DDT is able to penetrate further than the wax layer.

Kemp (P. B.). **The Termites of north-eastern Tanganyika: their Distribution and Biology.**—*Bull. ent. Res.* **46** pt. 1 pp. 113–135, 7 pls., 2 maps, 10 refs. London, 1955.

In this survey, which is based on investigations in north-eastern Tanganyika in 1950–52, two methods of estimating the abundance of subterranean termites are described, the region is divided into eight vegetation zones, and a list is given showing the termites that were found in each, followed by notes on the habits and castes of the individual species in the field and, in some cases, in the laboratory. The only species associated with buildings were *Schedorhinotermes lamanianus* (Sjöst.), alates of which swarmed over the walls of a house and disappeared into cracks near the ceiling, and *Coptotermes amanii* (Sjöst.), alates of which emerged from the lintel of a door and cracks in the stone wall. The latter species is commonly found in structural timbers and is locally abundant in woodland. The Calliphorid, *Bengalia floccosa* (Wulp), was observed preying on the workers of several species in woodland and thicket areas.

Solomon (M. E.). **The relative Control Values of different Percentage Mortalities.**—*Bull. ent. Res.* **46** pt. 1 pp. 189–191, 1 graph, 1 ref. London, 1955.

The following is the author's summary. Percentage mortality by itself is not a good measure of the practical value of an insecticidal treatment.

In a relatively simple case, such as the fumigation of stored products, the control value can be expressed in terms of the time required for the reduced population to return to its former level of density, provided the mode of increase of the population is known.

Assuming that increase is at a regular exponential rate, the control values of different mortality percentages can be compared in terms of the calculated recovery times; thus, each of the values in the series 99·6, 93·75, 75, 50 and 29 per cent. mortality is twice as good as the one that follows it. Such relationships can be deduced from the graph provided, which is essentially a curve of constant exponential growth, made linear by the use of the logarithmic scale.

The above comparisons do not depend on the value of the constant rate of increase. If the rate of increase varies, control values can still be compared so long as it is possible to calculate the relative times needed for recovery from different levels of density.

Williams (C. B.), French (R. A.) & Hosni (M. M.). **A second Experiment on testing the relative Efficiency of Insect Traps.**—*Bull. ent. Res.* **46** pt. 1 pp. 193–204, 1 fig., 2 refs. London, 1955.

The following is based on the authors' summary. In the further experiment at Rothamsted described [*cf. R.A.E.*, A **40** 68], light-traps of two types (the Rothamsted and Robinson traps) were each used with ordinary electric light and ultra-violet light. The four traps concerned were operated simultaneously between 11th May and 23rd September at four sites in woodland in cycles of six nights, in such a way that at each site each trap followed itself, each of the others and a night of no trapping. The complete cycle was repeated four times. All insects captured were sorted, and each order was analysed separately. By analysis of variance (after transforming the numbers caught to a logarithmic scale), it was possible to show separately the effect of differences between nights, between sites, between types of trap, between types of light, and between cycles, and also the effect (if any) of the previous night's trapping. It was found that ultra-violet light was more efficient for all orders than ordinary electric light, that the Robinson trap, in which the light is just above the entry and there is no roof, was more efficient than the Rothamsted trap, in which the light is inside and there is an opaque roof, for the larger Lepidoptera but much less efficient for the small Diptera, and that there was no regular effect of the previous night's trapping. The largest source of variation was the difference between nights; difference between sites was small.

Mohan Babu Naidu. **Physiological Action of Drugs and Insecticides on Insects.**—*Bull. ent. Res.* **46** pt. 1 pp. 205–220, 8 figs., 31 refs. London, 1955.

The following is substantially the author's summary. Studies were made of the action of certain drugs and insecticides on the frequency of the beat of the isolated heart of *Periplaneta americana* (L.) immersed in an aerated physiological solution at 29°C. [84·2°F.], to which the drugs were added [*cf. R.A.E.*, A **39** 368, etc.]. Acetylcholine (ACH) at a concentration of 5×10^{-8} to 10^{-5} caused a sustained acceleration of the heart-beat that was blocked by atropine (5×10^{-5}) and unaltered by hexamethonium (5×10^{-5}), prolonged exposure to nicotine (5×10^{-5}), or ergotamine (3×10^{-6}). In this range of concentration, ACH had a " muscarine-like " action. Adrenaline

(3×10^{-6} to 5×10^{-8}) also caused an acceleration of the heart-beat, which soon passed off. Nor-adrenaline had the same action. Nicotine, hexamethonium or atropine did not modify the action of adrenaline, but ergotamine antagonised it. Nicotine (5×10^{-5}) produced an acceleration of the heart-beat that declined with prolonged exposure until ultimately no effect was produced on reapplication, but recovery occurred with sufficient washing. Hexamethonium antagonised the effects of low concentration of nicotine. It is concluded that nicotine acts on the cardiac ganglia. Since atropine substantially reduced the action of nicotine, it is suggested that the ganglia excited may be chiefly cholinergic. ACH in high concentration (10^{-3}) in the presence of atropine (5×10^{-5}) had a stimulant effect that was abolished by nicotine. It is inferred that under these conditions ACH stimulates ganglia that may be adrenergic. Atropine (5×10^{-5}) itself stimulated the heart somewhat, and this action was abolished by nicotine. Eserine (5×10^{-6} to 10^{-5}), like ACH, caused a sustained acceleration of the heart-beat. Its stimulant action was blocked by atropine and unaltered by nicotine. It was found to potentiate the action of ACH and nicotine and not that of adrenaline.

The effects of pyrethrum were partially antagonised by low concentrations of atropine and completely by higher concentrations. Prolonged nicotine action did not modify the action of pyrethrum, but previous treatment with pyrethrum at a low concentration substantially reduced the effect of nicotine. It is concluded that pyrethrum acts both on the ganglia and at the neuromuscular junction by the release of ACH and not by virtue of an anti-cholinesterase action. Rotenone acted as a cumulative poison. The actions of ACH and nicotine were completely and that of adrenaline partially antagonised by it, while prolonged nicotine action did not modify its inhibitive action. Pure parathion had no effect on the frequency of the heart-beat, but after treatment with ultra-violet rays parathion accelerated it and potentiated the action of ACH. Atropine abolished the effect of irradiated pure parathion. It is suggested that, after exposure to ultra-violet rays, pure parathion is converted to some isomer that has anti-cholinesterase property. Paraoxon was found to act on the heart in a similar manner to pure parathion exposed to ultra-violet rays. DDT caused much irregularity in the heart-beat with a decline in the rate of frequency, and its effect was not modified by atropine. It appears that the action of DDT is not due to an anti-cholinesterase property.

Brown (E. S.). *Pseudotheraptus wayi*, **a new Genus and Species of Coreid (Hemiptera) injurious to Coconuts in East Africa.**—*Bull. ent. Res.* **46** pt. 1 pp. 221–240, 16 figs., 17 refs. London, 1955.

Pseudotheraptus, gen. n., is erected for *P. wayi*, sp. n. (the type), *P. ugandae*, sp. n., and *P.* (*Theraptus*) *devastans* (Dist.). All three species are described from adults of both sexes, and a key to them is given. *P. wayi* is the Coreid that causes early nutfall of coconut in East Africa and has hitherto been referred to as *Theraptus* sp. [*cf. R.A.E.*, A **42** 326, etc.]. It is recorded from coconut and cashew (*Anacardium occidentale*) in Kenya and Tanganyika, from cacao in Pemba, and also from Zanzibar [*cf. loc. cit.*]. Specimens from these areas showed slight morphological variations, but not sufficient to warrant the separation of subspecies [*cf.* **42** 327]. *P. ugandae* was collected in forest in Uganda, and *P. devastans* is recorded from cassava (*Manihot utilissima*) in Nigeria and also occurs in the Belgian Congo [**5** 504; **6** 80; **32** 416], the Gold Coast, and the Cameroons. Notes are given on the remaining species of *Theraptus*, and on the taxonomic

relations of *Pseudotheraptus* to other genera, with special reference to *Theraptus* and *Amblypelta*. The latter includes *A. cocophaga* China, which causes damage to coconuts in the British Solomon Islands [*cf.* **22** 490; **29** 324, etc.] identical with that due to *P. wayi*.

Chaverri (E.). **Anotaciones sobre la biología del *Antianthe expansa* Germar, plaga del pimiento en Costa Rica.** [Notes on the Biology of *A. expansa*, a Pest of Peppers in Costa Rica.]—*Rev. Biol. trop.* **2** fasc. 2 pp. 269–282, 9 figs., 7 refs. San José, Costa Rica, 1954. (With a Summary in English.)

Descriptions are given of all stages of *Antianthe expansa* (Germ.), a Membracid that damages sweet peppers (*Capsicum annuum*) in Costa Rica, together with an account of observations on its bionomics and control. The eggs were laid in groups in slits in the cortex, usually that of the thicker stems, and though dissected females contained about 20 eggs each, groups of 39–48 newly hatched nymphs, apparently from the same batch of eggs, were commonly observed. The nymphs hatched in 16–25 days, depending on temperature, with an average of 20 days. They began to feed almost immediately, moving to small stems and shoots, and were attended by three species of ants that fed on their sugary excretions. The nymphal stage lasted 90 days, and the adults survived for only a week. All stages were present together on the plants, which were infested only if they were large enough to provide shade. Damage resulted both from the interruption of the vascular bundles caused by the oviposition wounds and from the feeding of the nymphs on the sap. The younger plants sometimes died as a result of the attack, and the shoots and young leaves withered on the older ones. The Mymarid, *Anaphoidea latipennis* Crwf., was reared from field-collected eggs, and Syrphid larvae attacked both nymphs and adults. Sprays of DDT, γ BHC and chlordane are stated to be effective against the nymphs, and control is facilitated by the destruction of wild food-plants of the genera *Cestrum*, *Solanum* and *Acnistus*.

Reeks (W. A.). **The Establishment of introduced Parasites of the European Spruce Sawfly (*Diprion hercyniae* (Htg.) (Hymenoptera: Diprionidae)) in the Maritime Provinces.**—*Canad. J. agric. Sci.* **33** no. 5 pp. 405–429, 3 figs., 35 refs. Ottawa, 1953.

Large numbers of introduced parasites were liberated for the control of *Gilpinia* (*Diprion*) *hercyniae* (Htg.) on spruce in eastern Canada in 1934–49, the majority during the severe outbreak that ended in 1939. Seven species were recovered, and the author summarises records of parasitism by these during and after the outbreak based on investigations in the Maritime Provinces and in two areas in Quebec, discusses their establishment at various levels of the host population, their spread from liberation points and their distribution in Canada, and gives brief accounts of the seasonal development of the most important of them, with special reference to aspects of their behaviour that affect establishment.

Two parasites that attack *G. hercyniae* in the cocoon were recovered, *Aptesis basizona* (Grav.), which was not numerous, and *Dahlbominus fuscipennis* (Zett.), which was obtained in large numbers. *D. fuscipennis* requires a high host density for maximum effectiveness, and has not been recovered from the very light populations that have prevailed since 1941. The five species of larval parasites recovered comprised four of *Exenterus* [*cf. R.A.E.*, A **41** 57] and *Sturmia* (*Drino*) *bohemica* (Mesnil). Only a

single example of *E. tricolor* (Roman) was obtained. *E. claripennis* Thoms. and *E. amictorius* (Panz.) showed rapid establishment under conditions of high host density but were recovered infrequently after the end of the outbreak. *E. vellicatus* Cushm. and *S. bohemica* were slow in becoming established, and their effectiveness was not apparent until the end of the outbreak, but they proved the most persistent of the introduced parasites at low host densities and might be equally effective at higher ones if they have a long enough period for multiplication before the host population reaches its peak. *E. vellicatus* spread at least 50 miles in seven seasons, *D. fuscipennis* 6½ miles in two seasons, and *S. bohemica*, which was also reared from *Pikonema alaskensis* (Rohw.) and *P. dimmockii* (Cress.), 16–25 miles in 12 seasons [*cf.* **37** 271].

Braun (E.), MacVicar (R. M.), Gibson (D. R.), Pankiw (P.) & Guppy (J.). **Studies in Red Clover Seed Production. Part II.**—*Canad. J. agric. Sci.* **33** no. 5 pp. 437–447, 1 fig., 7 refs. Ottawa, 1953.

In the course of further investigations on the production of red-clover seed in Ontario [*cf. R.A.E.*, A **40** 157], insecticides were applied to a field in 1951 at the rate of 1·5 lb. active ingredient in 50 U.S. gals. water per acre, either singly or in combination, on 3rd August (just before bloom) or 29th August (full bloom). Pre-bloom or full-bloom applications of DDT, alone or with toxaphene, and a pre-bloom application of DDT followed by toxaphene at full bloom caused no significant differences in seed yield, which was extremely low throughout the experimental area. Sweeps before and after application indicated that the pea Aphid [*Macrosiphum pisum* (Harris)] and the tarnished plant bug [*Lygus lineolaris* (P. de B.)] were controlled by the treatments, but not the red-clover seed midge [*Dasyneura leguminicola* (Lint.)], which damaged about 70 per cent. of the flower heads. The observations indicated that there was no excessive mortality of honey bees and no disturbance of the brood-rearing cycle within the colonies.

Bucher (G. E.). **Biotic Factors of Control of the European Fir Budworm, *Choristoneura murinana* (Hbn.) (n.comb.), in Europe.**—*Canad. J. agric. Sci.* **33** no. 5 pp. 448–469, 1 pl., 2 figs., 7 refs. Ottawa, 1953.

The author gives short accounts of the life-history and habits of *Choristoneura* (*Tortrix*) *murinana* (Hb.) [*cf. R.A.E.*, A **30** 207–208], which attacks *Abies alba* in Europe, and reviews the areas in which it has been found. Search in these led to the discovery in 1947 of a large population of economic importance in the Vosges Mountains of France and a smaller population of no significance in the Black Forest of Germany, and these were studied with a view to the discovery of natural enemies that might prove suitable for introduction into Canada against the spruce budworm, *C. fumiferana* (Clem.).

In three districts of the Vosges in May–June 1948, the total mortality of larvae of *C. murinana* in the fifth and sixth instars was 22·1–65·3 per cent., including 0·6–1·6 per cent. due to insect parasites, mainly *Glypta murinanae* Bauer, 0·1–6·8 per cent. to a fungus and 7·3–42 per cent. to a virus [*cf.* **38** 348; **40** 159] subsequently named *Bergoldia calypta* by Steinhaus. Parasitism of the pupae reached 5 per cent., and it is calculated that in the absence of death from other causes, larval parasitism would not have exceeded 2 per cent. or pupal parasitism 10 per cent.

In the Black Forest, only 53 per cent. of the feeding larvae pupated, 26 per cent. being killed by the virus and 3 per cent. by insect parasites,

mainly *G. murinanae*. Parasites of the pupae played an important part in control, the most important being *Itoplectis maculator* (F.), followed by *Phacogenes scutellaris* Wesm., *Pimpla turionellae* (L.), *Ephialtes inquisitor* (Scop.) and *Ichneumon pictus* Gmel. The total percentage parasitism of the pupae amounted to 24, and mortality due to it would have reached 33 per cent. in the absence of other causes. Notes on all the parasites observed and on the symptoms caused by the virus are included.

Ayoutantis (A. J.), Pélécassis (E. D.), Argyriou (L. C.), Mourikis (P.A.) & Tsacas (L. E.). **Rapport sur les travaux expérimentaux de lutte contre le *Dacus* a Roviès (Eubée) pendant l'année 1953.**—*Ann. Inst. phytopath. Benaki* **8** no. 1 [French edn.] pp. 3–75, 1 pl., 17 figs., 20 refs.; [Greek edn.] pp. 3–80 (French Summary pp. 78–80), 1 pl., 17 figs. Athens, 1954.

Experiments were begun in 1953 in a large grove on the island of Euboea to investigate the possibility of controlling *Dacus* [*oleae* (Gmel.)] on olive by means of a single application of parathion directed against the larvae present in the olives at the time of treatment and those hatching subsequently, and also to determine the amount of parathion retained in the oil at the time of pressing. The seasonal development of *Dacus* and the relation between it, *Prolasioptera* (*Lasioptera*) *berlesiana* (Paoli) and the fungus, *Macrophoma dalmatica* [*cf. R.A.E.*, A **35** 286, etc.] were also studied.

Counts of *Dacus* adults taken in bait-traps hung in the trees from June 1953 until June 1954 and consideration of the percentage of females with mature eggs showed that two generations and a partial third developed during the year, the peaks of emergence of the first two occurring from 8th to 13th August and 13th to 18th September, respectively, and adults of the third appearing on 23rd October. The peak of oviposition occurred at the end of September and the beginning of October, when the temperature averaged 21·7°C. [71·06°F.] and the relative humidity 65·1 per cent.; from observations throughout the summer it appeared that eggs were laid only when the relative humidity exceeded 60 per cent. Heavy rain from 6th to 14th October prevented much further oviposition, and the subsequent fall in temperature retarded larval development. Among females that emerged from overwintered pupae, the percentage with mature eggs rose from mid-February 1954 and reached 91 per cent. on 11th May, but these females disappeared suddenly, and apparently without ovipositing, as olives in a suitable stage of development were not available at that time, and were replaced by further females that developed from larvae that had not completed feeding before the onset of cold weather in November and probably overwintered in the fruits still on the trees. These females oviposited in olives in June and July.

A single application of parathion was made on 10th–12th September, when the oil content of the olives reached 3·6 per cent. and the larvae that hatched from the numerous eggs laid after late August were still in the early stages of development. The concentrations tested were 0·015–0·1 per cent. in emulsion sprays and 2 per cent. in a dust. The dust was ineffective, but in the sprays, 0·1 and 0·075–0·03 per cent. parathion gave complete mortality of larvae in the first two instars in the olives within three and ten days, respectively, and 0·015 per cent. killed 72 per cent. of them in ten days. There was little mortality of third-instar larvae or pupae. The apparent effectiveness of all treatments was reduced 20 days after application owing to recent heavy oviposition, but many of the resulting larvae were killed by the parathion retained in the olives. As a result,

0·1 per cent. parathion gave good protection until picking time, and 0·03 per cent. parathion for 65 days, while 0·015 per cent. gave 40 per cent. mortality after 45 days.

Difficulty was experienced in assessing the amounts of parathion retained in the olives, but it was found in special tests that the residues in parts per million in the oil were 0–0·1 at picking time in February for 0·025 per cent. parathion applied on 15th September and 2·4 for 0·1 per cent. applied on 12th September, this latter figure being below the official limit of tolerance of 3 p.p.m. established by the U.S. Food and Drug Administration [*cf.* **43** 85]. Residues exceeded the tolerance when the stronger spray was applied on 25th September. It is therefore recommended that a spray of 0·1 per cent. parathion should be applied in mid-September for lasting control throughout the rest of the season, preceded by one of 0·015–0·03 per cent. parathion for temporary control if attack becomes severe earlier in the summer. For smaller varieties of olives or those with a higher oil content, the concentrations should probably be reduced.

Investigation of the olives that fell before mid-October showed that attack by *Prays oleellus* (F.) was responsible for the fall of about two thirds of them, there being little difference between treated and untreated trees in the percentage of fallen olives showing exit holes of *Dacus*. The treatments had no appreciable effect on *Prolasioptera berlesiana* or on *M. dalmatica*, since the larvae of the Cecidomyiid do not penetrate the pulp where the parathion is retained. The studies on the latter showed that the fungus developed when a *Dacus* egg and one of *Prolasioptera* were placed in a nutritive solution in a test-tube, provided that the *Prolasioptera* egg hatched, but the presence of a *Dacus* egg alone did not ensure fungus development. When the eggs of both insects were removed from the fruits, the fungus did not appear on the latter. *Prolasioptera* was successfully reared on a fresh culture of the fungus, and it appeared that a *Dacus* egg was not indispensable for the development of *Prolasioptera* and the fungus in a fruit.

Dudovac. Rezultati dosadašnjeg rada na njegovom proučavanju i suzbijanju kod nas. [The Mulberry Moth. The preliminary Results of Investigations on it and its Control in our Country.]—*Plant Prot.* no. 16–17, 180 [+2] pp., 14 pls., 3 figs., 3 maps, 15 graphs (1 fldg.), many refs. Belgrade, 1953.

The following are abstracts of papers in this symposium dealing with the introduced *Hyphantria cunea* (Dru.) in Yugoslavia. All have summaries in English, French or German, and a bibliography on the Arctiid in Europe is appended (pp. 176–178).

Sisoyevit' (P.). *Exorista fallax* **Meigen (Dipt., Tachinidae)—a Parasite of the Mulberry Moth. Preliminary Report on Investigations in 1952,** pp. 5–18, 4 pls., 3 graphs, 9 refs. [*In Scrbian.*] An international laboratory for the study of *Hyphantria cunea* (Dru.) was set up at Palić, in the Voyvodina region of northern Serbia, in 1952, and investigations were carried out there in the same year on the parasites of the Arctiid. They included several Tachinids, which parasitised nearly 34 per cent. of the larvae. Of these, *Tachina* (*Exorista*) *fallax* Mg. represented 78·8 per cent., *Pales* (*Ctenophorocera*) *pavida* (Mg.) nearly 16 per cent., *Compsilura concinnata* (Mg.) nearly 4 per cent. and *T.* (*E.*) *larvarum* (L.) over 1·5 per cent., while individual examples of *T.* (*E.*) *fasciata* var. *moreti* R.-D. and *Ptychomyia* (*Bessa*) *selecta* (Mg.) were also obtained.

Investigations on *T. fallax* showed that it probably has 3–4 generations a year in the field and parasitises both *H. cunea* and *Stilpnotia salicis* (L.).

Oviposition occurs on the first-generation larvae of *S. salicis* in May, on the last-instar larvae of the first generation of *H. cunea* at the beginning of July, on second-generation larvae of *S. salicis* at the end of July, and on second-generation larvae of *H. cunea* in mid-August, and a high population of the parasite is thus maintained. Eggs were laid chiefly on the head of the host, usually singly but sometimes in batches, and the females deposited a maximum of 113 eggs in the laboratory. Usually only one larva of the parasite develops in that of the host, and occasionally two. The egg stage lasted less than two days at room temperature, and the larvae normally left their hosts after 7–10 days, though some entered diapause, presumably in the first instar, and passed the winter in this way in the host pupae, not leaving for up to 81 days. Other individuals overwintered as pupae in the soil. The pupal stage usually lasted 14–15 days in summer, but was extended to 39 days by unfavourably high humidity. The adults survived for a month or less.

Ehrenhardt (H.), Bachmann (F.), Diercks (R.) & Vogel (W.). **Beiträge zur Biologie und Bekämpfung von *Hyphantria cunea* auf Grund von Beobachtungen und experimentellen Untersuchungen am Internationalen Laboratorium zum Studium von *Hyphantria cunea* in Palić (Jugoslavien)** [Contributions to the Biology and Control of *H. cunea* based on Observations and experimental Investigations at the International Laboratory for the Study of *H. cunea* at Palić (Yugoslavia)], pp. 19–57, 2 pls., 8 graphs., 13 refs. *Hyphantria cunea* (Dru.) caused serious damage in northern Yugoslavia in 1950 and 1951 [*cf. R.A.E.*, A **42** 413], but was much less injurious, though more widespread, in 1952, when larvae of the second generation occurred only in a few localities and exclusively on mulberry. An account is given of investigations on the effect of different food-plants and temperatures on its development, carried out in June–October 1952 at Palić. In tests in which the temperature averaged about 25°C. [77°F.] and the relative humidity nearly 100 per cent., the eggs of the first generation hatched in eight days [*cf.* **41** 61], and the larval stage lasted 27–29 days on mulberry, 35 days on *Prunus avium* and *Acer platanoides*, 36–37 days on the tender foliage of apple suckers, 36–39 days on plum, 37 days on oak, 40 days on pear and 49–52 days on walnut. All larvae died on lime (*Tilia*), horse-chestnut (*Aesculus*) and tough apple leaves. Larval mortality was lowest on mulberry, and larvae reared on it produced the largest pupae. Feeding was at first voracious on walnut, but on reaching the fourth instar the larvae showed increasing aversion for it accompanied by rising mortality. The pupal stage lasted about a fortnight, and the adult females survived for 7–10 days. When the larvae were given a choice of mulberry and the leaves of each of 13 other fruit and shade trees, mulberry was preferred to all except *Acer negundo*. In investigations on the effect of temperature, the threshold of development of the eggs was found to be near 9°C. [48·2°F.]. At 18°C. [64·4°F.], the larvae hatched in 14 days, and completed their development on mulberry in 51 days.

In the field, the first generation of *H. cunea* was completed in about three months, whereas the second required only about half that time. Some of the pupae of the second generation gave rise to adults at the end of August, and third-generation larvae were present in the first half of September. They had only reached the second instar by the beginning of October, and many were killed by cold. The collapse of the outbreak was due partly to the activity of parasites and predators, but above all to unfavourable weather, larvae of the first generation being adversely affected by low temperatures in mid-May and those of the second generation suffering from abnormal heat and drought in August, which affected their food-plants.

In tests on control, leaves from mulberry sprayed in the field were brought

to the laboratory and larvae were confined on them at intervals between three hours and eight days after treatment. Apart from 0·5 per cent. lead arsenate, the sprays were prepared from commercial wettable powders of DDT alone or with BHC and emulsion concentrates of γ BHC or parathion. All proved effective against the first three instars, but were less satisfactory against older larvae, and all the organic materials except the DDT powder were considerably less toxic after eight days. In similar tests of these and other organic insecticides, parathion was the most toxic material to larvae in the sixth and seventh instars, and the results were not affected by ventilation of the cages. Field tests were carried out by spraying individual larval nests and the adjoining parts of the tree. DDT alone or with γ BHC caused almost all the larvae to leave their nests and the tree within 24 hours. BHC alone was slower in action, numerous larvae dying in the nests and the tendency to leave being less pronounced. Parathion gave poor results. In large-scale work on mulberry trees infested by larvae in the 4th–7th instars, good results were given by dusting with DDT or BHC and spraying with DDT or γ BHC, with little difference between dusts and sprays.

Bogavac (M.). **Neka zapažanja o parazitima dudovca** [Some Observations on Parasitism of the Mulberry Moth], pp. 58–80, 8 pls., 2 graphs, 4 refs. Observations on the development of *Hyphantria cunea* (Dru.) at Palić showed that it was greatly favoured by the prevailing rainy weather in 1951, but that in 1952 the young larvae were killed by frosts in May and by excessive heat in July. The seasonal occurrence of the adults and larvae in the two years, the trees on which the eggs were laid and the extent of the infestation are discussed. Both the spotted form (typical *cunea*) and the white form (*textor* Harr.) were present [*cf.* **38** 162; **41** 61], the former chiefly in spring and the latter in summer. In 1952, considerable control of the larvae was afforded by predators, of which the most effective were *Polistes gallicus* (L.) and *Chrysopa perla* (L.), which also destroyed the eggs. No egg parasites were observed, but at least 18 species of parasites, a list of which is given, were reared from the larvae or pupae. Of those that attacked the larvae, *Tachina* (*Exorista*) *fallax* Mg. was the most effective, followed by *T.* (*E.*) *larvarum* (L.) and *Pales* (*Ctenophorocera*) *pavida* (Mg.). *Apanteles plutellae* Kurd. was reared in small numbers from a few nests. Laboratory tests showed that females of this Braconid readily oviposit in the larvae while the nests are still thin, but are unable to reach them when the webbing has become thicker. They laid eggs in larvae in the second and third instars outside the nest. Development of the parasite lasted 14–24 days at the end of July and the beginning of August and 28–43 days in September and October, and mortality in the larval stage was high. When larvae of *H. cunea* were offered individually to females of the Braconid, one of the latter oviposited in 233 larvae in nine days and another in 91 larvae in five days. Of the pupal parasites, *Psychophagus omnivorus* (Wlk.) was the most numerous. At 16–27°C. [60·8–80·6°F.] and a relative humidity of 50–58 per cent. in the laboratory, development of this Pteromalid in first-generation pupae lasted 30–37 days, with an average of 31. In the field, it averaged less than 30 days in first-generation hosts in July–August and 45 days in those of the second generation. A few of the larvae in the latter entered diapause and completed development only in February–May of the following year. The adults survived longest (an average of 47·6 days for the males and 70·7 days for the females) at a mean temperature of 19·5°C. [67·1°F.], provided that honey was available. The number of mature eggs per female ranged up to 272 in a week-old example. The eggs were laid in up to five host pupae, and the maximum number of parasite adults that emerged from each of

the latter was 156. The two sexes were about equally numerous in the field, but males predominated in the laboratory.

Todorović (S.). **Borba protiv dudovca u NR Srbiji 1952 godine** [The Campaign against the Mulberry Moth in Serbia in the Year 1952], pp. 81–107, 1 fig., 1 map. By 1951, *Hyphantria cunea* (Dru.) had spread more than 62 miles southward from the Hungarian border of Yugoslavia [*cf.* **42** 413], and in 1952 it was present throughout the Voyvodina region, in 11 districts of Serbia south of the Sava and the Danube, and in 22 districts in Croatia, three in Slovenia and five in Bosnia. Its local distribution in Serbia in 1952 is reviewed, and an account is given of a large-scale campaign there for its control. The measures adopted were mostly mechanical, beginning in some districts at the end of April with organised collection of the moths by children. The cutting down and destruction of the larval nests was the only measure in most districts and proved very effective. Chemical control was applied on a small scale in other localities, ground apparatus being used to treat parks, orchards, and a small area of forest with a dust of 10 per cent. DDT or with proprietary spray products containing 10 per cent. DDT or BHC, all diluted to a concentration of 1·5 per cent., and aeroplanes for the release of an aerosol from a 16·5 per cent. DDT solution. All materials gave good results, mortality averaging 90–95 per cent. among young larvae and 85–90 per cent. among those in the fourth and fifth instars. Treatment of roadside trees from the air failed owing to wind.

Šmit (I.) & Maceljski (M.). **Dudovac na području NR Hrvatske u 1952 godini** [The Mulberry Moth in the Territory of Croatia in 1952], pp. 108–114, 2 figs., 1 map. In 1952, *Hyphantria cunea* (Dru.) occurred in 13 districts along the Hungarian border of northern Croatia in addition to nine that became infested in 1951. The frequent observation of single larval nests on trees along roads at considerable distances from the main foci indicated that spread was effected by transport of the larvae [*cf.* **40** 52]. Adults from the overwintered pupae appeared on 21st–23rd April, owing to the prevailing warm weather, but a cold spell in mid-May delayed development of the first-generation larvae, which caused no damage until the beginning of June. They gave rise to adults in mid-July, and second-generation larvae were present from 5th August to 5th September, when pupation began. In addition to mulberry, various fruit and shade trees were attacked, but the damage was seldom severe, larvae of the second generation being adversely affected by drought. Mechanical and chemical measures of control were applied, and good results were given by a BHC dust and a DDT spray.

Masten (V.). **Pojava dudovca u NR Sloveniji 1952 godine. Organizacija i izvođenje borbe protiv dudovca** [The Appearance of the Mulberry Moth in Slovenia in 1952. The Organisation and Application of Control], pp. 115–121, 1 map. *Hyphantria cunea* (Dru.) was found for the first time in Slovenia in June 1952, in a locality adjoining Croatia, and soon spread to the neighbouring district. Mulberry, apple, cherry and plum were infested, but the damage was light. First-generation larvae hatched in mid-June and gave rise to adults from 15th to 22nd July, and second-generation larvae were present throughout August. A few adults were produced in the autumn, and some of these oviposited, but none of the eggs hatched. The application of insecticides against the first generation was thought to be uneconomical, and good control was obtained by destroying the larval nests. In a few field experiments, spraying the trees with DDT gave good results. Chemical measures became necessary as the infestation increased, however, and DDT sprays were successfully applied from the ground. Owing to these and the drought that set in subsequently, the second generation was nowhere troublesome.

Novaković (V.). **Pojava i suzbijanje dudovca u Bosni 1952 godine**

[The Appearance and Control of the Mulberry Moth in Bosnia in 1952], pp. 122–123. *Hyphantria cunea* (Dru.) occurred in north-eastern Bosnia in June 1952, but infestation was light and did not spread. This is attributed to destruction of the larval nests and to the summer drought. The larvae were observed on mulberry, plum and apple, and to a less extent on walnut and shade trees. Subsequently, fresh centres of infestation were found at two places further west.

Milosavl'evit' (R.). **The Use of the Aviomethod for Destruction of the Mulberry Moth in Voyvodina in 1952,** pp. 124–128. [*In Serbian.*] In the course of the campaign against *Hyphantria cunea* (Dru.) in the Voyvodina region in 1952, aeroplanes were used for the application of an aerosol released from a 16·5 per cent. solution of DDT in spindle oil at the rate of 0·6–0·8 gal. per acre. The results were not satisfactory, as the aerosol failed to penetrate the larval nests and the deposits that were formed on village trees covered with dust were easily blown off with the latter by wind.

Hadžistević (D.). **Neka zapažanja o suzbijanju dudovca aviometodom u 1952 godini** [Observations on the Control of the Mulberry Moth by the Aviomethod in 1952], pp. 129–133. A Junkers W-34 and a PT-17 aeroplane were used to apply a thermal aerosol from a 16·5 per cent. solution of DDT at rates of 2·7–4·5 lb. per acre in the Voyvodina region against *Hyphantria cunea* (Dru.) in 1952. The particles released by the Junkers machine were much finer and better distributed over the surface of the leaves than those released by the PT-17. Good control of the larvae was obtained in orchards and forests, though the aerosol did not penetrate well into the interior of the nests owing to the thickness of the web. Affected larvae abandoned their nests, and considerable mortality was caused by the deposits on the leaves. Newly hatched larvae were the most susceptible. Treatment of roadside trees was ineffective, as even light currents of air carried the aerosol away.

Yordovit' (M.). **Aeroplane Control of the Larvae of the Mulberry Moth in northern Bachka in 1952,** pp. 134–137. [*In Serbian.*] A survey in a district in the northern Voyvodina region in 1952 showed that infestation by *Hyphantria cunea* (Dru.) was heaviest near inhabited places. Eggs occurred chiefly on the lower branches of the trees. Treatment with aerosols released from a 16·5 per cent. solution of DDT from an aeroplane gave good control of third-instar larvae on roadside trees at Subotica at 0·72–0·9 gal. per acre and in a park at Palić at 0·45–0·54 gal., when the weather was favourable.

Petrik (C.). **Bioekološka ispitivanja dudovca u uslovima Vojvodine** [Investigations on the Bioecology of the Mulberry Moth in the Voyvodina], pp. 138–174, 2 graphs (1 fldg.), 43 refs. The following is based on the author's summary of observations in 1950–52. *Hyphantria cunea* (Dru.) has two generations a year in the Voyvodina region, the pupae of the second usually hibernating and giving rise to adults in April or the beginning of May, though a few complete their development without hibernating and give rise to adults towards the end of August if the temperature in the preceding two months is high. Larvae of a third generation then occur in September, but all are killed by the cold. Most of the adults belong to the white form (*textor* Harr.); females of the spotted form (typical *cunea*) are rare, though the males are common in spring [*cf.* **41** 61]. The sex ratio is approximately 1:1, but varies somewhat with generation and year. At 22–24°C. [71·6–75·2°F.] and 50–60 per cent. relative humidity, the adults survived for 1–9 days, males living longer than females, especially at high humidity. The females usually contained 400–500 mature ovules, but only about 300 eggs were laid on an average, though there were wide individual variations. Eggs laid by unfertilised females shrivelled up.

Oviposition usually began within 1–2 days of emergence, and the eggs hatched in 4–11 days at 24–26°C. [75·2–78·8°F.]. The young larvae live gregariously in nests, whereas the older ones abandon the nests and feed separately [*cf.* **41** 61]. The larvae died after starvation for one day in the first instar, three in the second, two in the third, and 4–5 in the fourth, and starvation for shorter periods often prolonged development or prevented its completion in the later stages. The manner in which the larvae feed is described. Breeding experiments showed that the size of the larvae and pupae varied with the food-plant, but that there was no correlation between the two stages. The adult females are inactive and laid most of their eggs on the periphery of the crown or sometimes in denuded areas within it, though in this case always on the southern side of the tree. The rise and collapse of the outbreak of *H. cunea* in Voyvodina are discussed. The climatic conditions of the region are in general favourable to the moth, so that its disappearance is unlikely, but its numbers will be limited by the occurrence of late frosts and summer drought, and also by conditions that favour the emergence of second-generation adults in autumn, since their progeny do not survive and the overwintering population is thereby reduced. Natural enemies afford some control, but not enough to prevent the occurrence of occasional outbreaks. Spread is effected chiefly by accidental transport and by the wind, which blows mainly from the north-west in spring and early summer, and hardly at all by active flight.

VAN HOOF (H. A.). **Enkele gegevens over de melige koolluis** (*Brevicoryne brassicae* **L.) in het Geestmerambacht, en zijn bestrijding.** [Data on the Overwintering and Control of *B. brassicae* in Holland.]—*Tijdschr. PlZiekt.* **60** pt. 3 pp. 131–135, 1 map, 2 refs. Wageningen, 1954. (With a Summary in English.)

Cauliflower mosaic is sometimes common on cabbage grown in North Holland. The virus persists through the winter in cabbage grown for seed and is transmitted in spring by *Brevicoryne brassicae* (L.), which overwinters in the egg stage on the seed plants. The fundatrices are present in April–May and the first alates in late May or early June. Counts in 1952–54 showed that overwintered seed plants of red cabbage were more heavily infested than white cabbage or savoy, probably because the latter continue to grow in August–September and their outer leaves unfold, leaving the Aphids more exposed to parasites. Parathion sprays gave unsatisfactory control in 1952, since the Aphids congregate at the tips of the flower stalks and the wax layer of the leaves prevents parathion applied to the upper surface from passing to the lower one, but 0·05 per cent. Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate] applied as a spray to the overwintered plants on 1st and again on 29th June 1953 greatly reduced infestation on neighbouring young plants by July. This supported the finding that weeds are of little importance as winter hosts for the Aphid.

NIJVELDT (W.). **Two new Gall Midges associated with Reed** (*Phragmites communis* **Trin.) in the Netherlands.**—*Ent. Ber.* **14** no. 336 pp. 282–285, 14 figs. Amsterdam, 1953.

Descriptions are given of the adults of both sexes of *Giraudiella incurvans*, sp.n., which causes galls on the growing shoots of reed (*Phragmites communis*) in Holland, and of *Lestodiplosis gracilis*, sp.n., the larvae of which prey on the larvae of *G. incurvans*.

Nijveldt (W.). **Galmuggen van cultuurgewassen. V. Galmuggen, schadelijk voor de sierteelt.** [Gall-midges on cultivated Plants. V. Gall-midges on ornamental Plants.]—*Tijdschr. PlZiekt.* **60** pt. 3 pp. 152–156, 1 pl., 3 figs., refs. Wageningen, 1954. (With a Summary in English.)

The Cecidomyiids dealt with in this final part of a series [*cf. R.A.E.*, A **43** 60] comprise those injurious to ornamental plants in Holland. They are *Dasyneura affinis* (Kieff.) on violets (*Viola* spp.), *D. alpestris* Kieff. on *Arabis* spp., *D. tortrix* (F.Lw.) on *Prunus* spp. and *Thomasiniana oculiperda* (Rübs.) on rose. The injury caused is described, and the bionomics and distribution of *D. affinis* and *D. alpestris* are reviewed from the literature, the other two species having been dealt with in a previous part [**40** 359].

It is pointed out in a postscript to the series that the raspberry midge, *T. theobaldi* Barnes [*cf.* **40** 359], is now common in parts of Holland, and reference is made to recent records of injury in that country to willow (*Salix amygdalina*) by *Rhabdophaga triandraperda* Barnes, to clovers (*Trifolium* spp.) and *Medicago lupulina* by *D. trifolii* (F.Lw.), and to reed (*Phragmites communis*) by *Giraudiella incurvans* Nijveldt [*cf.* preceding abstract].

Ehrenhardt (H.). **Über die Wirkung des Hexachlorcyclohexans als systemisches Insektizid.** [On the Action of BHC as a systemic Insecticide.]—*Anz. Schädlingsk.* **27** pt. 1 pp. 1–5, text illus., 11 refs. Berlin, 1954.

Experiments were carried out in 1951–53 to determine whether BHC is absorbed by plants, particularly through the roots [*cf. R.A.E.*, A **41** 427, etc.] and, if so, the fate of the insecticide in the plant tissue. Young wheat and tomato plants were used, and the tissues were tested for toxicity mostly by confining adults of *Drosophila* on them and noting subsequent mortality.

In a preliminary test, wheat seeds were allowed to sprout in pots containing soil treated with γ BHC at 1 oz. per 20 cu. ft. and the base of the shoot above the coleoptiles, part of the stem covered by the leaf sheath, and the growing tip were removed and tested after 9, 12 and 31 days, when the seedlings were about 5·5, 7·5 and 12·5 ins. high, respectively. All parts proved toxic to *Drosophila*, the mortality percentages being 40, 100 and 100 after the three intervals, respectively, for the stems, 90, 100 and 80 for the bases, and 40, 10 and 20 for the tips. Similar results were obtained when the seeds germinated in a 2-in. untreated soil layer above the treated soil, so that only the roots came in contact with the latter, toxicity of the tips declining rapidly with growth between 5 and 14 days and that of the other parts between 14 and 35 days. There was no mortality in the untreated controls.

Since toxicity might have been the result of the deposition of BHC on the upper part of the plant following vaporisation from the treated soil, this was prevented in further tests by a plastic cover closely sealed round the coleoptiles, which protruded through it. The wheat seedlings were germinated in untreated soil and transferred to moistened filter paper previously treated with 0·01 cc. of a 0·1 per cent. γ BHC solution per sq. cm. They were removed and tested three days later, and it was found that 50 per cent. mortality of the flies resulted in less than nine hours when the whole had been covered during treatment with a glass hood and in about 11 hours when it had not. When the seedlings were transferred to soil treated with 1 oz. γ BHC per 20 cu. ft. and the dish was not covered with the glass hood, the

period was some 40 hours. In control tests, the plastic cover was not used and the seedlings were transferred to moist blotting paper in dishes over but not entirely covering the treated filter paper. The periods for 50 per cent. mortality were a little over 1·5 hours when the whole had been covered with the glass hood and nearly 24 hours when it had not. It is concluded that although BHC is deposited on the plant, as shown by the toxicity observed in the last pair of tests, it is absorbed to a greater extent by the roots and translocated in the plant, as shown in the others. In no case was BHC detected in the drops exuded by the hydathodes.

The translocation of the BHC was more closely studied in tomato plants about 14–16 ins. high standing in flasks containing a nutrient solution to which 0·1 per cent. γ BHC emulsified solution was added; the neck of the flask was sealed round the stem, and the interior was ventilated through side tubes. After three days, various parts of the plants were tested for toxicity, and the numbers of minutes required for 50 per cent. mortality of *Drosophila* exposed to them were 41 for the base of the main stem above the lower leaves, 63 for the top of the stem and 70–1,300 for the leaf stalks, those in the middle of the plant being the most toxic. The main veins of the leaves proved as toxic as an equal amount of leaf stalk, and they were therefore removed in subsequent tests with leaf tissues, which themselves and the tips of the plants were practically non-toxic. Since it appeared unlikely that translocation to these parts was prevented by the fineness of the veins and no BHC could be detected in macerated leaves or in acetone extracts from them, it is concluded that the BHC that reaches them is given off relatively quickly. Such vaporisation would be rapid where the finely branched conductive tissues approach the surface.

The rapidity of translocation was investigated by caging *Drosophila* on different parts of tomato plants in nutrient solution to which the γ BHC was added as before. The mortality percentages reached 100 on the lower stem and the petiole of the second leaf, 35 on the upper stem about 10 ins. above the cork and 20 on the petiole of the sixth leaf in one day, 100 on the upper stem and the petiole of the sixth leaf in two days, and 100 on the leaflets of the third leaf in five days. When a part of the main stem was dissected into three concentric layers, all three were about equally toxic.

The 0·1 per cent. BHC emulsified solution was injurious to the tomato plants, which failed to develop new roots in it, and the solvents and emulsifiers present caused the leaves at the base to wither, usually within three days. In tests similar to those described but with 0·2–0·4 per cent. emulsified solutions, the times required for 50 per cent. mortality of *Drosophila* were not materially altered. BHC (γ isomer) is soluble in water to the extent of 0·001 per cent., and *Drosophila* is sensitive to it at that concentration. In tests with single leaves or whole plants in nutrient solution containing 0·01 per cent. γ BHC emulsified solution or aqueous solutions of γ BHC with or without the addition of 0·01 per cent. emulsifier the periods required for 50 per cent. mortality of *Drosophila* confined on them after 3 or 8 days were about the same for corresponding parts of the plants and varied between 2 and 18 hours. These periods corresponded to concentrations of 0·005–0·0005 per cent. γ BHC, which indicated that the insecticide was taken up in proportion to its solubility in water.

Nolte (H. W.). **Über Knospen- und Rindengallen der Pflaumen.** [On Bud and Bark Galls on Plum.]—*Anz. Schädlingsk.* **27** pt. 1 pp. 6–7, 4 figs., 12 refs. Berlin, 1954.

Both the Cecidomyiid, *Ischnonyx prunorum* (Wachtl), and the mite, *Eriophyes phlococoptes* (Nal.), cause galls on the young shoots of plum in

Germany, the first on the buds and the second on the bark. The two types of galls are described, characters differentiating them are given, and the literature on the distribution, natural enemies and control of *E. phloeocoptes* is briefly reviewed.

Bauers (C.). **Versuche mit Toxaphen-Staub zur Feststellung der Bienengefährlichkeit und der Wirkung gegen Kohlschotenrüssler und Rapsglanzkäfer.** [Experiments with Toxaphene Dust to determine its Toxicity to Bees and its Effectiveness against *Ceuthorrhynchus assimilis* and *Meligethes aeneus*.]—*Anz. Schädlingsk.* **27** pt. 3 pp. 35–36, 6 refs. Berlin, 1954.

In view of reports of the low toxicity of toxaphene to honey bees [*R.A.E.*, A **38** 412; **39** 345; **40** 343], its suitability for application to cruciferous crops in flower for the control of *Ceuthorrhynchus assimilis* (Payk.) and the rape beetle [*Meligethes aeneus* (F.)] was investigated in Schleswig-Holstein in 1953. In laboratory tests, bees exposed for five minutes in petri dishes to dust deposits of toxaphene at rates equivalent to 9 and 18 lb. per acre were unaffected after 11 hours, though mortality of treated and untreated bees was complete after 21 hours, probably because of the low night temperature. The same deposits and exposure period caused complete mortality of adults of *C. assimilis* in 21 hours and of *M. aeneus* in 14·5 hours.

In a field test, swedes in flower were dusted at 18 lb. per acre, and a hive of bees was brought to the field. The bees visited the flowers without interruption, and mortality was no greater than normal. On the following day, infestation had fallen from an initial four examples of each pest per plant to 0·34. Heavy rain fell eight hours after treatment, and reinfestation began at the edge of the field after two days. The treatment was repeated in this area at 22·5 lb. per acre, and this caused 85–90 per cent. mortality of the pests, with no loss of bees. The field was uninfested four days later. In a second test on swedes, the toxaphene dust was compared with E 605 Staub [2 per cent. methyl-parathion] against the two pests, the first material being applied at 22·5 and the second at 18 lb. per acre. Each caused 90–95 per cent. mortality of both insects in 24 hours, though heavy rain fell 9·5 hours after dusting. Toxaphene subsequently gave consistently good results against *C. assimilis* in practice, with no reported loss of bees. Treatment was carried out in fine weather, with day temperatures of about 20°C. [68°F.], which may have assisted control. A period of at least 8–10 hours without rain is considered essential, as the initial effect of toxaphene is slight.

Koch (M.). **Zur Biologie des Kiefernprozessionsspinners, *Thaumetopoea pinivora* Tr.** [The Bionomics of the Pine Processionary.]—*Beitr. Ent.* **3** no. 4 pp. 423–427, 12 refs. Berlin, 1953.

Thaumetopoea pinivora (Treitschke) is locally common on pine in northern Germany east of the Elbe and also near Dresden. Observations in the latter locality showed that the adults are present in July–August. The eggs are laid round the needles and overwinter, and the larvae hatch at the end of April or the beginning of May. They become full-fed in July and pupate in hard soil. The pupae overwinter and give rise to adults in the following July and August, though some overwinter again and thus prevent an absolute alternation of years in which either larvae or adults alone occur.

ELLIOTT (M.). **Allethrin.**—*J. Sci. Fd Agric.* **5** no. 11 pp. 505–514, 9 figs., 46 refs. London, 1954.

The author reviews work on the structure and synthesis of the acid and alcoholic components of the pyrethrins, which led to the preparation of the closely related synthetic compound, allethrin (the ester of *dl-cis-trans*-chrysanthemic acid with *dl*-allethrolone) [*cf. R.A.E.*, B **38** 103, 208, etc.], and gives the results of tests to determine the relative insecticidal activity and abundance of the eight isomeric esters present in it [*cf.* B **40** 116].

The relative contact toxicities to *Phaedon cochleariae* (F.) of the esters formed by *d*-allethrolone with *d-trans*-chrysanthemic acid, *dl*-allethrolone with the *d-trans* and *dl-trans* acids, and *l*-allethrolone with the *l-trans* acid were 100, 64, 22 and 0·03, respectively. The relative toxicities of the esters of *dl*-allethrolone with the *d-* and *dl-trans*, *d-* and *dl-cis*, *dl-cis-trans*, *l-cis* and *l-trans* acids were 100, 35, 21, 15, 32, 2 and 3 in tests on *P. cochleariae* and 100, 56, 63, 32, 37 and 6 for the first six in tests on *Tenebrio molitor* L. The relative toxicities of some of these esters of *dl*-allethrolone in tests against other insects (100 for the *d-trans* acid ester in each case) were 46, 48 and 85 for *dl-cis-trans* against *Plutella maculipennis* (Curt.), *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.) and *Oryzaephilus surinamensis* (L.), 72, 33 and 3 for *dl-trans*, *dl-cis* and *l-trans* against *Plutella*, and 53 and 25 for *dl-trans* and *dl-cis* against *Dysdercus fasciatus* Sign.

Spectrum analysis of the allethrin used in these tests, carried out by Crombie, showed that it contained 75 per cent. of the *trans* and 25 per cent. of the *cis* acids. The discrepancy between this result and that obtained biologically [B **41** 125] may be due to variations in the ratios of α and β isomers [*cf.* B **40** 117] in the *dl-trans*-acid ester of *dl*-allethrolone, in the *dl-cis* ester (for which they must exist, although they have not yet been separated) and in allethrin itself, since the α and β forms have different insecticidal activities. Such a variation might be produced by different reaction conditions and varying, non-stoicheiometric ratios of the reagents used in the preparation of the esters.

The effect of various changes in the molecule of allethrin on insecticidal activity is discussed. The biological action of the compound appears to be of a similar nature to that of the natural pyrethrins, and is associated with the particular stereochemical conformation in which the various parts of the molecule are held with respect to one another and with the chemical and physical properties of the groups so positioned. No esters of chrysanthemic acid, except those with alcohols closely related to pyrethrolone, cinerolone or allethrolone, have been reported to show characteristic pyrethrin-like activity, and the only acids that give insecticidal esters of the keto-alcohols are closely related to chrysanthemic acid.

Although allethrin is inferior to the natural pyrethrins against most species of insects and by most methods of application, it is highly active and, unlike many modern synthetic insecticides, has, so far, been found harmless to mammals.

EL RAFIE (M. S.). **Fumigation of agricultural Products. X. Sorption of Carbon Disulphide by Wheat and Flour.**—*J. Sci. Fd Agric.* **5** no. 11 pp. 536–541, 7 graphs, 13 refs. London, 1954.

In this part of a series [*cf. R.A.E.*, A **43** 3, etc.], it is pointed out that although carbon bisulphide is widely used in tropical and subtropical countries as a grain fumigant, little is known of the extent to which it is sorbed on grain or grain products, and an account is given of laboratory experiments in which this was investigated. When English wheat containing

9 or 17·8 per cent. moisture was fumigated for a week at 25°C. [77°F.] with carbon bisulphide at 100 mg. per litre, sorption increased rapidly at the higher moisture content, and much more slowly at the lower one. Further tests with wheat containing 8–20 per cent. moisture showed that sorption was at a minimum at a moisture content of 14 per cent., that very little fumigant was sorbed irrecoverably and that the amounts of fumigant firmly sorbed and lightly sorbed both rose sharply between moisture contents of 14 and 18 per cent.

On wheat, wholemeal flour or patent (white) flour containing 13 per cent. moisture, the recoverable fumigant was less strongly sorbed at high temperatures (35–40°C. [95–104°F.]) than at a low one (15°C. [59°F.]), indicating that it was held by predominantly physical forces. Sorption was greater on the two ground materials than on the whole grains, and considerably greater on wholemeal flour than on the patent flour, from which the bran and germ is removed; the amount of unrecovered fumigant was much less dependent on either temperature or the nature of the flour. Comparison of sorption on whole wheat, wholemeal flour, the patent flour, and the bran and germ from English wheat under comparable conditions indicated that the unrecovered fumigant is held mainly in the endosperm, the main constituent of the patent flour. Although the germ holds a relatively large amount of carbon bisulphide, there was no evidence of chemical reaction, all the sorbed fumigant being recoverable from it. When whole grain and wholemeal flour were fumigated at different moisture contents, the quantity of carbon bisulphide sorbed changed from about 200 and 650 parts per million, respectively, at 7 per cent. moisture content to about 400 p.p.m. at 17–18 per cent. moisture content; the free surfaces available for sorption in the flour appeared to decrease as the water content increased, but this effect was masked in the whole grains by the greatly increased permeability of the seed-coat. It is concluded that carbon bisulphide is sorbed on wheat to a less extent than is methyl bromide, ethylene oxide or hydrogen cyanide.

It appears that sorption of carbon bisulphide is appreciably lower than that of methyl bromide [*cf. loc. cit.*] and that an even smaller proportion of the sorbed fumigant is not recovered. Elaborate arrangements for airing grain fumigated with carbon bisulphide seem to be unnecessary, the ordinary processes of transport and milling being likely to remove about 70 per cent. of the recoverable fumigant. Increasing the period of fumigation beyond the customary lengths of 24–48 hours produces little increase in sorption, so that fumigation for a longer period at low concentrations seems to be an efficient means of attaining a given concentration-time product. Since increasing the moisture content from 13 to 18 per cent. doubles the sorption, low moisture content during fumigation is important.

As sorption, with its attendant risks of taint or loss of viability of seeds, does not increase sharply with rise of temperature for carbon bisulphide as it does for most fumigants, this compound is particularly suitable for use under tropical conditions.

Cvetanović (R. J.) & Pielou (D. P.). **Preparation of standard Films of crystalline p-p′-DDT for Laboratory Investigation by Sublimation.**— *Canad. J. Tech.* **32** pp. 174–178, 3 figs., 15 refs. Ottawa, 1954.

A thin, wholly crystalline and uniformly dense film of p,p′DDT, containing a prescribed amount over a given area, can be prepared by vaporising a known amount of DDT and depositing it on a cooled flat glass plate. In a technique developed for this purpose, a known amount of pure

p,p'DDT in acetone is put in a hemispherical dish, the solvent is allowed to evaporate, and the dish is thoroughly dried in a desiccator and closely covered with a cleaned glass plate, also dried. When the dish is heated from below and the glass plate cooled from above, the DDT vaporises and is deposited on the plate in the form of minute supercooled globules that tend to crystallise into a branching arrangement of microcrystals. Deposits containing amounts of DDT suitable for most experimental purposes crystallise in 1–2 days when kept in a desiccator. The percentage of the total area covered by the crystals for a given concentration of material depends on the temperature of the evaporating and condensing surfaces and the number of centres of crystallisation induced. Experiments showed that pure p,p'DDT was not decomposed by heating for 30 minutes at temperatures up to 180°C., and as DDT can be transferred by subliming even at a temperature as low as 90–100°C., a considerable range of temperature can be used for the application of DDT by this technique. The rate of transfer is a function of the partial vapour pressure of the DDT and increases as the temperature rises. In the apparatus described, a temperature of 160°C. was found convenient.

Bird (F. T.). **On the artificial Dissemination of the Virus Disease of the European Pine Sawfly,** *Neodiprion sertifer* **(Geoffr.).**—*Bi-m. Progr. Rep. Div. For. Biol. Can.* **8** no. 3 pp. 1–2, 1 fig., 1 ref. Ottawa, 1952.

In tests in Ontario in 1951 on the use of the virus introduced from Europe for the control of larvae of *Neodiprion sertifer* (Geoffr.) on pine [*cf. R.A.E.*, A **41** 22], a mist-blower was used to apply suspensions of virus material to infested trees from a stationary position on the windward side. A preliminary test having given promising results, two further plots were treated. In one, 8,300 cc. suspension containing 2,000,000 polyhedra per cc. caused heavy mortality over five acres when applied from two points 200 ft. apart with a wind of about 800 ft. per minute, and in the other, heavy mortality over seven acres was caused by 11,800 cc. suspension containing 20,000,000 polyhedra per cc. applied from one point with a wind of 1,690 ft. per minute. Traces of mortality were observed 900 ft. from the mist-blower in the second case. Experiments showed that an increase in the volume of suspension applied greatly increased the area over which mortality was caused, but this was not appreciably increased by raising the concentration of the virus beyond 1,000,000 polyhedra per cc. It is therefore concluded that large volumes of weak suspensions are more effective than small ones of strong suspensions. The best results were given by applications made between 9 p.m. and midnight, when the relative humidity was high and the mist remained suspended in the air for long periods.

Hughes (K. M.). **The Development of an Insect Virus within Cells of its Host.**—*Hilgardia* **22** no. 12 pp. 391–406, 16 figs., 16 refs. Berkeley, Cal., 1953.

The following is based on the author's summary. The development of the virus, *Borrelina campeoles* of Steinhaus, in larvae of *Colias eurytheme* Boisd. [*cf. R.A.E.*, A **40** 62, etc.] was studied by examining thin sections of the fat tissue of infected examples under an electron miscroscope. It was shown that rod-shaped virus particles appear in large numbers in the nucleus of an infected cell. The rods form bundles of two or more members, apparently surrounded by a membrane. A dense substance appearing within the membrane renders that structure opaque. Deposition of

polyhedral protein around and between a number of bundles results in the formation of a small polyhedron containing bundles of virus particles. The polyhedron apparently grows by the progressive deposition of polyhedral protein at its periphery and the entrapping of adjacent bundles within its mass. The relationships of these findings to those of other authors is discussed.

PRADHAN (S.) & SATPATHY (J. M.). **Bioassay of Insecticides. II. Comparative Toxicity of some important Insecticides to** *Oxycaraenus laetus* **Kirby (Lygaeidae: Hemiptera) and** *Rhopalosiphum pseudobrassicae* **(Davis) (Aphididae: Hemiptera).**—*Indian J. Ent.* **15** (1953) pt. 4 pp. 297–298, 1 ref. New Delhi, 1954.

In further investigations in India on the relative toxicity of recently developed insecticides to important insects [*cf. R.A.E.*, A **42** 260], examples of *Oxycarenus laetus* Kby. were liberated on dried spray deposits in dishes, which were then covered with pieces of muslin, so that a fumigant effect was avoided as far as possible, and *Rhopalosiphum pseudobrassicae* (Davis) was sprayed in a spray tower on pieces of muslin that were subsequently folded over to form bags. No food was supplied. The insecticides were applied in emulsion sprays at various concentrations and the results analysed statistically. On the basis of 50 per cent. mortality in 48 hours, parathion, γ BHC, aldrin and a thiocyanate preparation (Lethane 384) were 43·72, 2·62, 1·1 and 0·11 times as toxic, respectively, as DDT to *O. laetus*, and parathion, γ BHC, aldrin and chlordane 32·68, 24·14, 0·85 and 0·34 times as toxic, respectively, as DDT to *R. pseudobrassicae*.

CHATTERJI (S.). **Effect of Humidity on some Pests of stored Cereals.**—*Indian J. Ent.* **15** (1953) pt. 4 pp. 327–339, 2 refs. New Delhi, 1954.

The author describes tests in which 200-gm. samples of cleaned wheat with initial moisture contents of 5, 8 and 12 per cent. were each infested with 50 adults of *Rhizopertha dominica* (F.), *Sitotroga cerealella* (Ol.) or *Calandra* (*Sitophilus*) *oryzae* (L.) and stored at 75 or 35–40 per cent. relative humidity, and of similar experiments with sorghum infested with 50 adults of *R. dominica*, *C. oryzae* or *Corcyra cephalonica* (Stnt.). Observations made after nearly 5½ months showed that the percentage of grains damaged was in all tests significantly higher at 75 than at 35–40 per cent. relative humidity. Some of the samples kept at 75 per cent. were attacked by fungi. Injury was greatest in grain with an initial moisture content of 12 per cent. and decreased significantly with decreasing moisture content except for wheat infested by *S. cerealella*, which showed no significant difference between moisture contents of 8 and 5 per cent.

Loss in weight did not differ significantly at the two levels of relative humidity for *S. cerealella* in wheat, but was significantly higher for 75 than for 35–40 per cent. relative humidity in the other five cases. It was significantly greatest at 12 per cent. moisture content and decreased significantly with moisture content for *R. dominica* in either grain, but did not differ significantly between 8 and 5 per cent. for *S. cerealella* or *Calandra oryzae* in wheat or for *C. oryzae* or *Corcyra cephalonica* in sorghum.

It is concluded that the higher humidity and the highest initial moisture content of the grain were the most favourable for insect activity and that except at the lowest moisture content, the surrounding humidity was more

important than the initial moisture content. The loss of weight and the percentage of damaged grains were relatively much higher at 12 per cent. moisture content than at 8 and 5 per cent.

PINGALE (S. V.). **Impregnation of Jute Bag Containers with Insecticides for protecting stored Food-stuffs: I. Efficacy of Piperonyl Butoxide-Pyrethrins.**—*Indian J. Ent.* **15** (1953) pt. 4 pp. 343–351, 1 graph, 10 refs. New Delhi, 1954.

Jute bags are much used for the storage of foodstuffs in India, but afford no protection against insects. Tests were therefore carried out to assess the value of impregnating them with pyrethrins, piperonyl butoxide or 1:10 mixtures of the two to protect grain or flour stored in them.

In preliminary tests, pieces of jute fabric were treated and stretched over dishes filled with wheat meal, and adults of *Tribolium castaneum* (Hbst.), *Calandra oryzae* (L.) and *Rhizopertha dominica* (F.) and larvae of *Trogoderma granarium* Everts were confined on the fabric for eight days, immediately or 1, 2 or 4 months after treatment. Examination 48, 96 and 192 hours after release showed that deposits of 5–30 mg. pyrethrins per sq. ft. repelled all three species and were toxic to adults of *Calandra* and *Rhizopertha*, both effects persisting for two but not four months, that those of 50–300 mg. piperonyl butoxide per sq. ft. had a similar but much weaker effect, which, however, persisted for four months, and that those of 5–30 mg. pyrethrins with 50–300 mg. piperonyl butoxide per sq. ft. had a similar but much stronger and more lasting effect, indicating synergism. None of the treatments killed either *Tribolium* or *Trogoderma*, and the responses of these species to the mixed films after exposure to them for 48, 96 or 192 hours showed little difference, indicating that penetration of the fabric was not increased by continuous association with the insecticide. Insects that passed through the treated fabric developed and bred, *Calandra* at the normal rate and the others more slowly.

In a further experiment, jute bags impregnated with mixtures of piperonyl butoxide and pyrethrins at 100:10, 200:20 or 300:30 mg. per sq. ft. were filled with uninfested wheat and stored at 90°F. and 70 per cent. relative humidity in chambers into which 1,000 individuals of the species already mentioned and 250 eggs of *Corcyra cephalonica* (Stnt.) and *Ephestia cautella* (Wlk.) were introduced. Counts of each species in the grain once a month showed that the *Calandra* population, which was low at the beginning of the experiment, soon rose, and it was so high after two months, with practically no difference between treated and untreated bags, that the experiment was discontinued. The other species did not increase above a low level. When similarly treated bags containing infested flour were stored in the presence of *Rhizopertha*, *Tribolium*, *Trogoderma*, *Corcyra* and *Ephestia*, infestation had not risen above a relatively low level after four months; in flour infested by *Tribolium*, *Corcyra* and *Ephestia*, treatment of the bags with the two higher dosages appeared to check fresh infestation, but permitted the insects already in the bags to multiply.

AGARWALA (S. B. D.). **A Note on the Control of the Sugarcane Thrips (*Fulmekiola sacchariciola* R. & M.) in Bihar.**—*Indian J. Ent.* **15** (1953) pt. 4 pp. 379–381. New Delhi, 1954.

Fulmekiola sacchariciola Ramakrishna & Margabandhu is widespread on sugar-cane throughout the year in Bihar, but rarely injures the crop. Field-scale damage by this thrips, consisting of a yellowing of the tips and edges

of leaves as they unfold, was first reported in 1949, and seedlings were injured in July 1952. Infestation of the latter is highest in the hot weather and declines with the onset of the monsoon, but large populations may destroy many valuable plants. In control experiments, sprays of 0·5–2·5 per cent. DDT or 0·12–0·58 per cent. BHC (0·015–0·075 per cent. γ isomer) were applied in the field at 100 gals. per acre. Examination before and three weeks after treatment showed significant reductions in population due to treatment with 0·5–1·5 per cent. DDT and 0·12 and 0·58 per cent. BHC; six weeks after treatment, all populations had dwindled, even on untreated plants, and significant results were not obtained. The highest yields were given by the lowest concentration of DDT and the highest of BHC. Of several insecticides applied to seedlings grown in pans in the culture house, only 0·1 per cent. DDT caused a significant reduction in the percentage of leaves damaged.

CHATTERJI (S.). **Biological Notes on** *Chaetostricha mukherjii* **Mani, (Hymenoptera: Trichogrammidae) an Egg Parasite of** *Bruchus analis* **Fabr.**—*Indian J. Ent.* **15** (1953) pt. 4 pp. 382–383, 3 refs. New Delhi, 1954.

Studies on the bionomics of the Trichogrammatid, *Chactostricha mukerjii* Mani [*cf. R.A.E.*, A **24** 764], were carried out in the laboratory at New Delhi in April–June 1950 at temperatures of 77–99°F. and 60 per cent. relative humidity, with eggs of *Bruchus analis* F. as hosts. Parasite adults paired within an hour of emergence, and oviposition began within a further 2–3 hours. Usually only one egg was deposited in each host egg, but two females were sometimes found ovipositing in the same one; only one parasite adult developed from such an egg. When 20 host eggs one day old and 20 two days old were exposed together to a parasite female, the latter oviposited in about 12 and 3, respectively, and when batches of 30 of each were separately exposed, single females oviposited in 8–20 and 6–14, respectively. Little oviposition occurred in eggs three days old, the maximum parasitism observed being only 1·6 per cent.

The egg, larval and pupal stages of *C. mukerjii* lasted at most one, 3–4 and 2–3 days, respectively, and the life-cycle was completed within six days in late May and early June and within seven in late April and early May; 60–90 per cent. of the eggs gave rise to adults in April and May, and 25–40 per cent. in June. Adults lived for 1–2 days in the absence of food, ovipositing females surviving for 5–6 hours longer than non-ovipositing ones. Females predominated in the cultures. Eggs of *Corcyra cephalonica* (Stnt.) and *Sitotroga cerealella* (Ol.) were not attacked.

BÖHM (H.). **Der Marlinger Birnwurm—ein neuer Schädling unserer Birnen.** [The Marling Pear-worm. A new Pest of Pears in Austria.]—*Pflanzenarzt* **5** no. 12 pp. 1–2, 3 figs. Vienna, 1952.

Cydia (*Carpocapsa*) *dannehli* Obraztsov was found infesting pears grown near Vienna in the summer of 1952 and was also observed in pears imported from the South Tyrol, where it is a serious pest [*cf. R.A.E.*, A **43** 22], and Czechoslovakia. All stages of the moth are briefly described, and its bionomics and distribution are reviewed. The countries from which it is recorded [*cf. loc. cit.*] include Poland.

Nietzke (G.). **Beiträge zur Biologie und Epidemiologie der Zwiebelminierfliege** *Dizygomyca* [*sic*] *cepae* **Her.** [Contributions to the Biology and Epidemiology of the Onion Leaf-miner, *Phytobia cepae*.] —*Z. angew. Ent.* **35** pt. 3 pp. 249–270, 19 figs., 11 refs. Berlin, 1953.

Field and laboratory investigations were carried out in 1937–40 on the bionomics of *Phytobia* (*Dizygomyza*) *cepae* (Her.) near Landau, in the Rhine Palatinate, where this Agromyzid had been observed a few years previously causing severe damage to onions [*cf. R.A.E.*, A **20** 8]. Its distribution in Europe is briefly reviewed, and all stages are described. It appeared that though a strain found at Oggersheim, near Ludwigshafen, was identical with material from the type locality of Calbe, one from Herxheim, near Landau, where the main observations were made, differed from it in many respects.

Adult flight began early in May, reached its climax during the first half of June and practically ceased in July, when the onions were harvested. The flies were most numerous when temperatures were high and relative humidity low, and least numerous under the reverse conditions. The females first appeared about a week before the males and outnumbered them by about 8:1. In the laboratory, four survived for eight days and three for 14. The females punctured the onion leaves, usually near the tip, with the ovipositor and fed on the sap that exuded. They attempted to puncture other surfaces, such as glass, in the laboratory, but ignored drops of water placed on them or on leaves, though the water was readily taken by the males. Pairing occurred on the leaves soon after emergence, and eggs were deposited singly in slits below the epidermis, mostly at the centre or base of the leaf. A single female in the laboratory deposited 27 eggs. The larvae hatched in 5–6 days at 21°C. [69·8°F.] in the laboratory and mined the leaves, reaching the base by the time they were full-fed. The blotch mines described from Calbe were encountered at Oggersheim but not at Ottersheim or Herxheim. Pupation occurred in the soil at a depth of 2–3½ ins., and the pupae overwintered in diapause, only very few of those kept from October onwards at 20 or 26°C. [68 or 78·8°F.] in the laboratory giving rise to adults before the spring and some collected in the field in August not doing so until September of the following year. Two parasites were reared from the puparia [**30** 163].

Hornig (H.). **Die Bedeutung der Drehherzmücke** (*Contarinia nasturtii* **Kieffer**) **für den Kohlrübenanbau unter besonderer Berücksichtigung der Verhältnisse in Schleswig-Holstein.** [The Significance of *C. nasturtii* for Swede Cultivation with special Reference to Conditions in Schleswig-Holstein.]—*Z. angew. Ent.* **35** pt. 3 pp. 271–318, 13 figs., 26 refs. Berlin, 1953.

Swedes are extensively grown for fodder in parts of Schleswig-Holstein, and considerable loss has been caused in recent years as a result of infestation by *Contarinia nasturtii* (Kieff.) and subsequent heart rot. All stages of the Cecidomyiid are described, its distribution is reviewed, and an account is given of investigations on its bionomics and control carried out in 1951–52, the results of which are compared with those recorded in the literature, where it is known mainly as a pest of cabbage [*cf. R.A.E.*, A **40** 189, etc.].

The eggs were laid mostly in batches of 8–10, generally on the young parts of the plant, and though many eggs were found on the outer foliage after rain, the larvae failed to become established there. The larvae

hatched in 5–6 days at average day temperatures of 18–19°C. [64·4–66·2°F.], and in 12–14 days at 10°C. [50°F.] and became full-fed in 10–12 days in July, 12–14 in August and 25–30 in September–October. They then entered the upper layer of the soil and pupated in cocoons that were formed 3–5 days later in summer, but not for 3–4 weeks for some individuals of the overwintering generation. Full-fed larvae in dishes of moist sand in the laboratory formed cocoons on about the third day, and pupation began on about the fifth. When additional layers of sand 2–6 ins. deep were added to the dishes after larvae of the first and second generations had burrowed beneath the surface, many of them moved upwards before pupating. Those that did not failed to complete their development, death occurring in the pupal stage. The importance of sufficient humidity for larvae about to form cocoons in the soil [*cf.* **32** 84] was confirmed, and it is shown that the proportion of third-generation larvae that overwintered varied inversely with temperature, as also did the duration of the pupal stage. In the laboratory at 18–21°C. [64·4–69·8°F.], adults of the first three generations emerged 10–14 days after the larvae entered the soil. Females were more numerous than males. The latter usually emerged first but died within 24 hours, whereas the females survived for several days. The adults sheltered under the foliage in the field and could not be taken by sweeping with a net; only females were captured by a suction trap.

There were four generations in 1952, of which the last was only partial, and probably the same number in 1950 and 1951. Adults emerged in the field from June to September, but the dates of maximum infestation varied from year to year. The cruciferous food-plants of *C. nasturtii* are reviewed, and it is concluded that the heavy infestation of swedes is due to the long growing period of this crop, though cabbage plantings, particularly those intended for seed, were important for the development of the first generation. Swedes sown in late April or early May were more severely attacked than those planted out after mid-June. Infestation began at the edges of the fields with oviposition by females of the overwintered generation, but spread over the whole, except in the case of very large areas, with the development of the first-generation adults.

Many larvae were parasitised by Platygasterids, the ratio of parasites to *C. nasturtii* being 1:3·8 among adults reared from field-collected larvae. Parasitism was heaviest in June–July. In rearing tests, most parasite adults emerged 15–16 days after the first adults of the Cecidomyiid in June–July, and 20–22 days after them in August, development from egg to adult lasting 30–35 days. Varietal differences were observed in the susceptibility of swedes to infestation, though none of 16 varieties tested was immune. Cultural control measures are discussed, those recommended including tilling the soil when the larvae are about to pupate, removing the foliage for fodder in autumn before larvae of the last generation have left the plants, and planting out after mid-June rather than sowing in the fields early in May. A complete programme of chemical control would prove too expensive for a forage crop, but tests were made with partial control programmes directed against the adults only and designed to prevent severe infestation so far as possible. Several proprietary dusts and sprays were effective against adults of the overwintered generation if applied when emergence was at its height, but the correct time for treatment could not be reliably predicted. Treating the edges of a field only did not prevent infestation spreading subsequently to the centre, but yields of roots and leaves were considerably increased by dusting a whole field against the first-generation adults. The emergence of these is easier to forecast, and any contact insecticide having a long duration of effectiveness is considered suitable.

Treatment was normally required only when the percentage of plants infested by the first generation exceeded 20.

DE MOL VAN OUD LOOSDRECHT (W. E.). **Die Kohlensäure-Sauerstoff-Druckmethode zur Bekämpfung der Grossen Narzissenfliege** (*Lampetia equestris* **F.).** [The Control of the Daffodil Fly (*Merodon equestris*) by Carbon Dioxide and Oxygen under Pressure.]—*Z. angew. Ent.* **35** pt. 3 pp. 319–338, 9 figs., 10 refs. Berlin, 1953. (With a Summary in English.)

In experiments with *Narcissus* bulbs infested by larvae of *Merodon* (*Lampetia*) *equestris* (F.), irradiation with X-rays at dosages that were harmless to the bulbs afforded no control and exposure to high-frequency electromagnetic waves gave inconsistent results, but treatment with a 1:4 mixture of carbon dioxide and oxygen at a pressure of 12 atmospheres for 24–48 hours [*cf. R.A.E.*, A **41** 235] killed all the larvae, including those about to pupate, without injury to the bulbs.

BECKER (G.). **Einige Beobachtungen über holzzerstörende Insekten (Termiten und Käfer) in Guatemala.** [Some Observations on wood-destroying Insects (Termites and Beetles) in Guatemala.]—*Z. angew. Ent.* **35** pt. 3 pp. 339–373, 38 figs., 37 refs. Berlin, 1953.

This survey of wood-destroying termites and beetles in Guatemala is based on the literature and on observations in March–July 1951. The termites were the more numerous and important and were present mainly at the lower altitudes. By far the most injurious was *Cryptotermes brevis* (Wlk.), which causes much damage to timber in houses in Guatemala City and other places. Other termites that injured building timbers, or power poles, wooden fences, etc., comprised *Heterotermes* and *Coptotermes* spp., *Nasutitermes corniger* (Motsch.) and *N. ephratae* (Hlmg.). The beetles recorded are mainly those observed attacking pine in forests at altitudes of over 6,500 ft., where an outbreak of *Dendroctonus* was in progress [*cf. R.A.E.*, A **41** 132], but oak timbers in a building were attacked by *Lyctus planicollis* (Lec.) and pinewood in others by *Eupactus* (*Calymmaderus*) *pupatus* (Gorham), *E.* (*C.*) *throscoides* (Gorham) and *Hylocurus beckeri* Heqvist. *Astyochus tenebrosus* (Bates) was injurious to power poles in forests. Mines typical of Bostrychids were frequently and those of Cossonines occasionally seen in wooden bridges. The distribution of the various species collected is shown in tables and discussed. Whereas most of the termites are widely distributed outside Guatemala, particularly towards the south, the majority of the beetles are restricted to Guatemala and Mexico and the remainder are predominantly of more northern origin.

SCHIMITSCHEK (E.). **Die Bestimmung von Insektenschäden im Walde nach Schadensbild und Schädling.** [The Identification of Insect Damage in Forests according to the Injury caused and the Pest.]—9¼ × 6¼ ins., 196 pp., 290 figs. Hamburg, &c., P. Parey, 1955. Price *DM.* 19.80.

This book consists almost entirely of keys for the identification of the insects and mites that attack forest trees and some fruit trees in Germany and other parts of central Europe. They are based on the damage caused and, when necessary, on the general appearance of the pest in its feeding stage, relate to nursery and seed pests, pests of conifers and deciduous trees

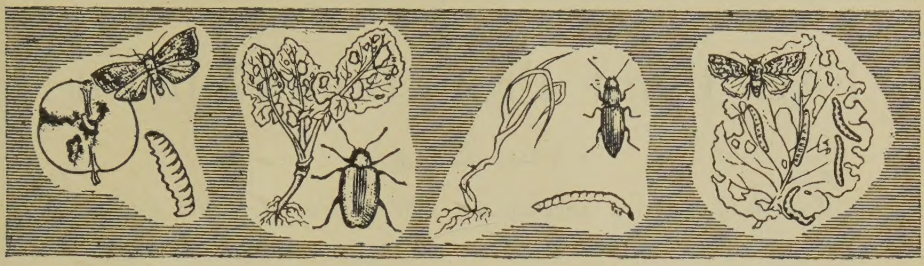
in plantations and forest stands, and willow pests, and are arranged according to the tree and the part infested. Two final keys are included, one to insects that attack timber in store or used for constructional or other purposes, and the other to the larvae or nymphs of the groups of insects that are of greatest importance as forest pests. There is an index to the German and scientific names of the pests concerned, and another to the trees.

Petersen (B. B.). *Hylesinus micans.* **Artens udbredelse og en oversigt over dens optraeden i Danmark.** [*Dendroctonus micans.* Its Distribution and a Review of its Occurrence in Denmark.]—*Dansk Skovforen. Tidsskr.* 1952 pt. 6 pp. 299–322, 2 maps, 33 refs. Copenhagen, 1952. (With a Summary in English.)

Dendroctonus (*Hylesinus*) *micans* (Kug.) was of little importance in Denmark until about 1940, when it became numerous in plantations of Sitka spruce (*Picea sitchensis*). An enquiry in 1949 showed that the beetle occurred in some 80 localities, the distribution of which is shown on a map, and was still spreading. It was found on several species of spruce and pine, and infestation was most severe in stands on sandy soil and those over 30 years old. Breeding was observed in comparatively healthy trees, and many stands of *P. sitchensis* had to be felled prematurely as a result of the attack.

Wagn (O.). **Iagttagelser over optraeden af bladrandbiller** (*Sitona*-**arter**) **i baelgplanteafgrøder.** [Observations on the Occurrence of Pea and Bean Weevils (*Sitona* spp.) on leguminous Crops.]—*Tidsskr. Planteavl* **57** pp. 706–712, 2 figs., 2 refs. Copenhagen, 1954. (With a Summary in English.)

Sitona lineatus (L.) has hitherto been thought to be the principal species of its genus on leguminous crops in Denmark, but observations on lucerne at Lyngby in 1950–53 showed that *S. decipiens* Lindberg was the dominant species early in the season and *S. humeralis* Steph. later in all four years, while *S. lineatus* and *S. hispidulus* (F.) were much less numerous, and a similar distribution was found in other districts, though *S. lineatus* occasionally predominated. When other crops were compared, it was found that *S. hispidulus* and *S. sulcifrons* (Thnb.) were the main species on red clover and *S. hispidulus* and *S. flavescens* (Marsham) on white clover, *S. lineatus* being less numerous in both cases. However, *S. lineatus* was the only species on peas, vetch (*Vicia sativa*) and horse beans (*V. faba*). On alsike clover (*Trifolium hybridum*), *S. flavescens* formed 70 and *S. puncticollis* Steph. 30 per cent. of the population. The existence of definite food preferences was shown by counts of the weevils on adjoining plots of peas, red clover and lucerne in May 1952. *S. lineatus* was the only species on the peas, *S. lineatus, S. sulcifrons, S. flavescens, S. decipiens* and *S. hispidulus* comprised 41·4, 12·6, 9·2, 5·8 and 31 per cent., respectively, of the population on clover, and *S. lineatus, S. decipiens, S. hispidulus* and *S. humeralis* formed 15·9, 50·7, 4·4 and 29 per cent. of that on lucerne. In a laboratory test, *S. flavescens* accepted red and white clover, but not peas. Sweeps on lucerne in 1950 showed that numbers were highest from early May to early June and again from August to October, and similar results were obtained in the subsequent years. The two peaks doubtless represent the overwintered and first-generation adults, respectively. Brief descriptions of the adults of all seven species found are appended.



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